The American Journal of Surgery

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May 1953

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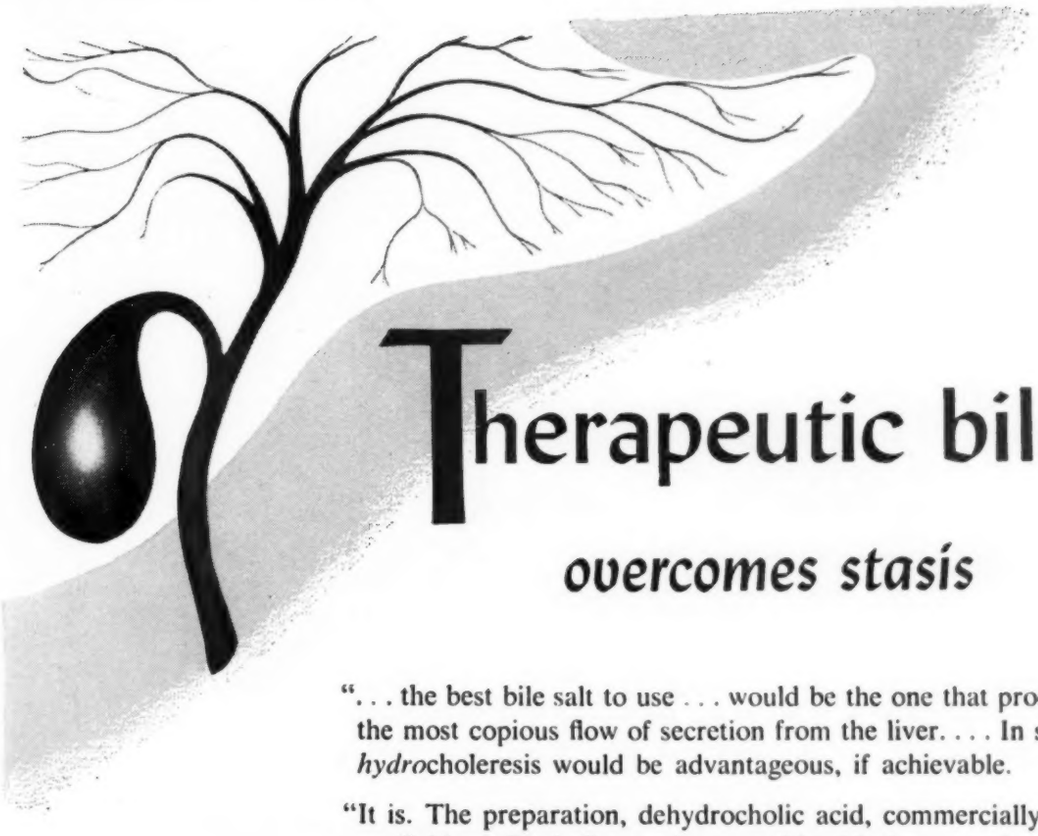

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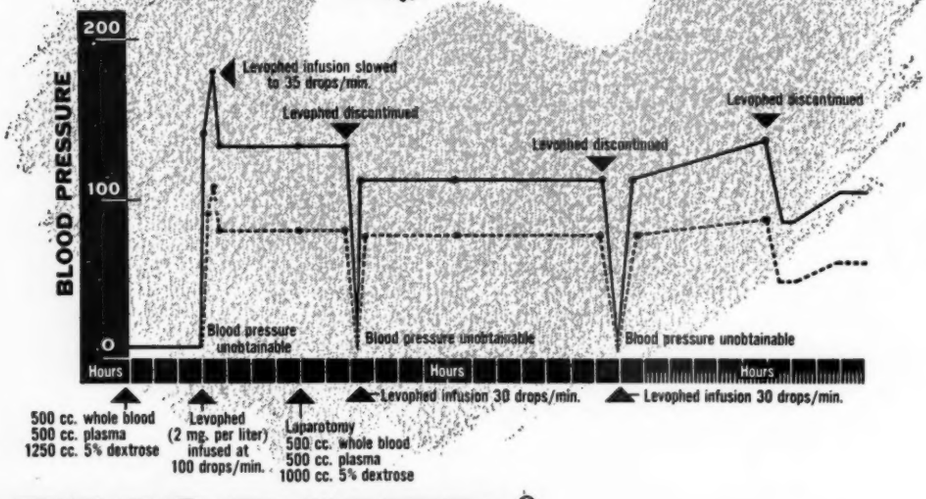

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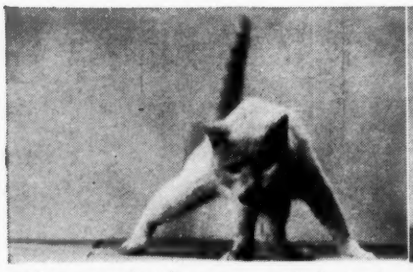
New principle in Streptomycin Therapy

The hazard of ototoxicity is greatly reduced by combining equal parts of streptomycin sulfate and dihydrostreptomycin sulfate. The patient thus gets only *half* as much of each drug. The risk of vestibular damage (from streptomycin) and of hearing loss (from dihydrostreptomycin) is greatly reduced. Therapeutic effect is undiminished. This principle has been demonstrated in both animals and man. In patients treated for 120 days with 1 Gm. per day of the combined drugs, the incidence of neurotoxicity was practically zero.



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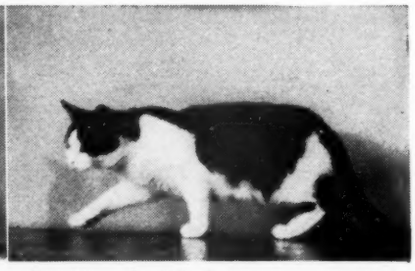

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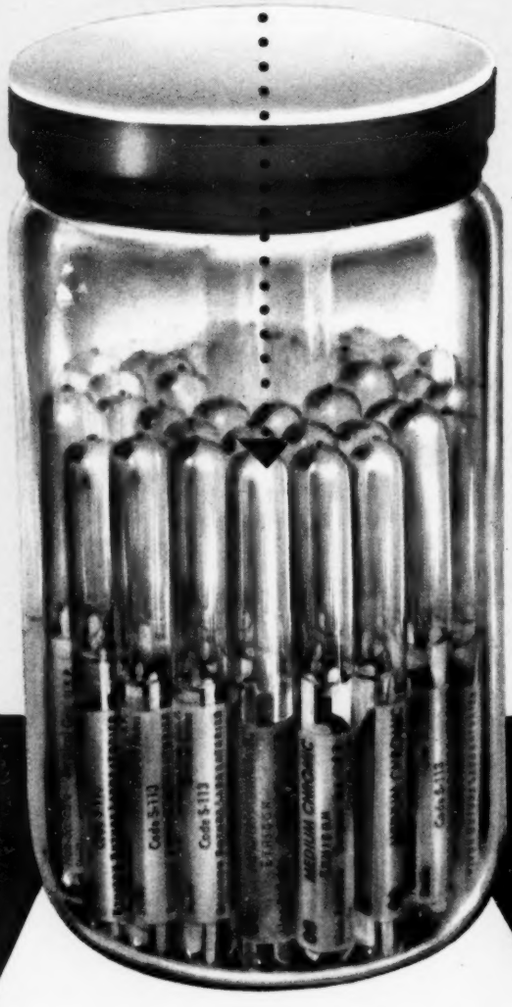

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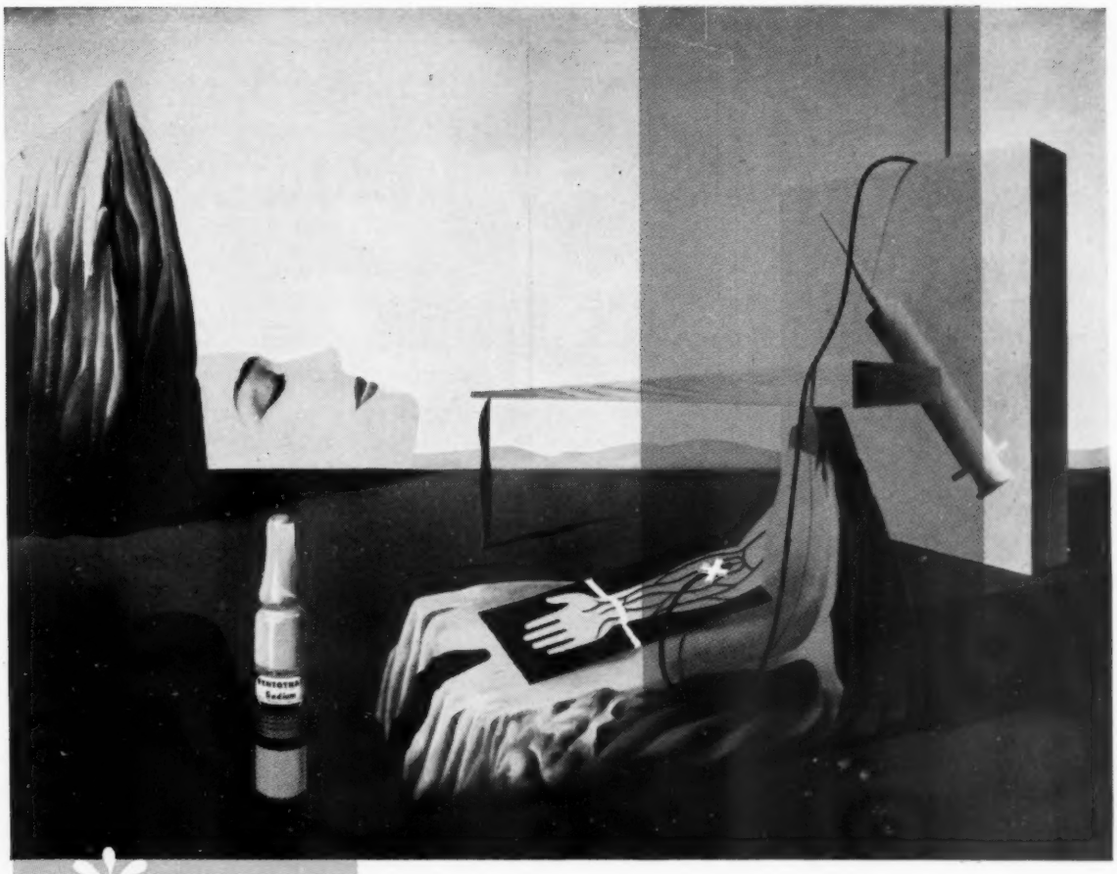

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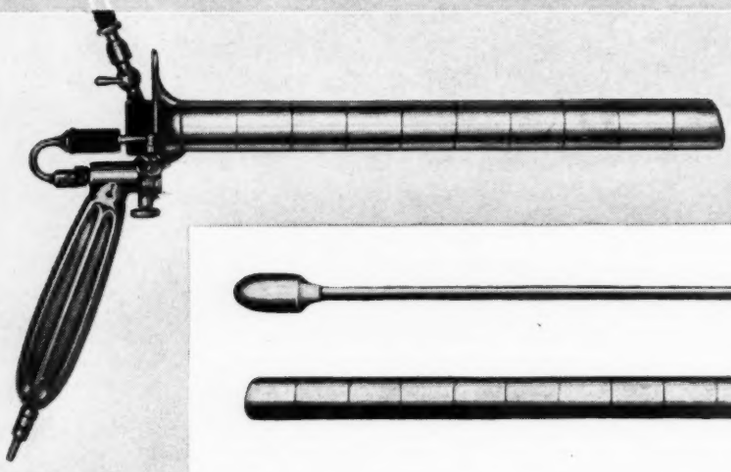

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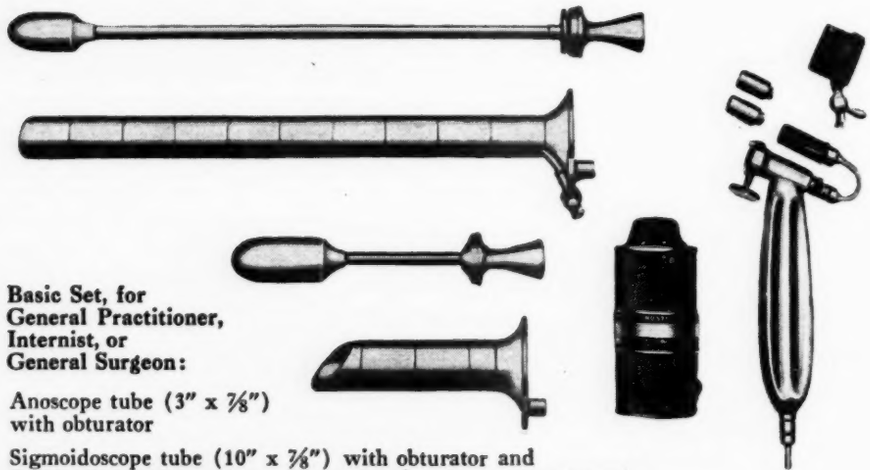

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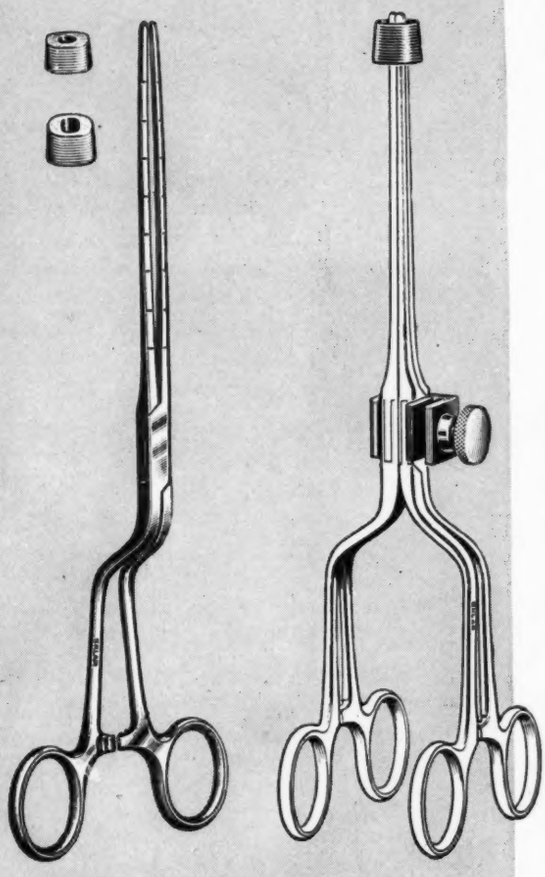

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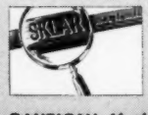

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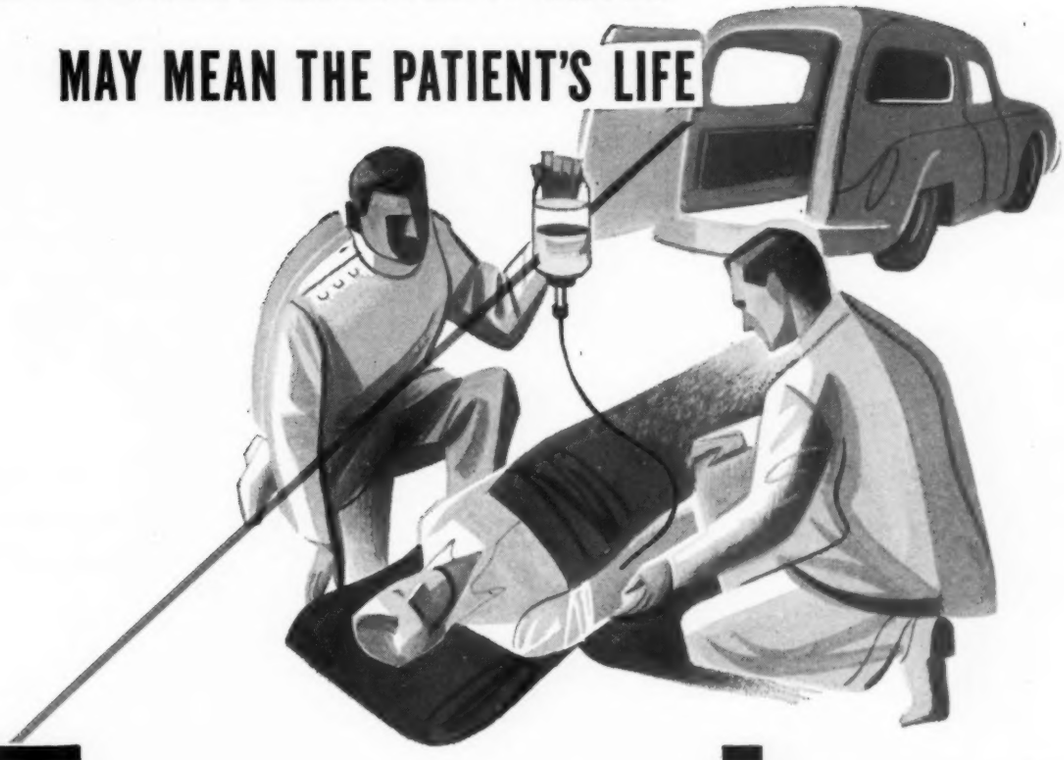

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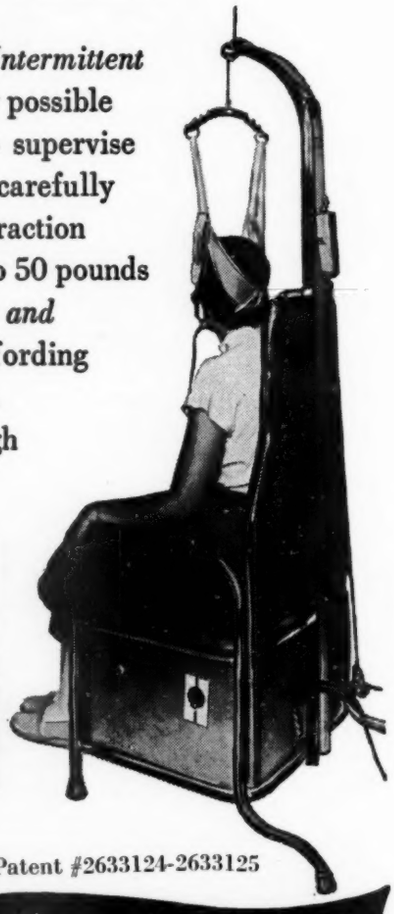

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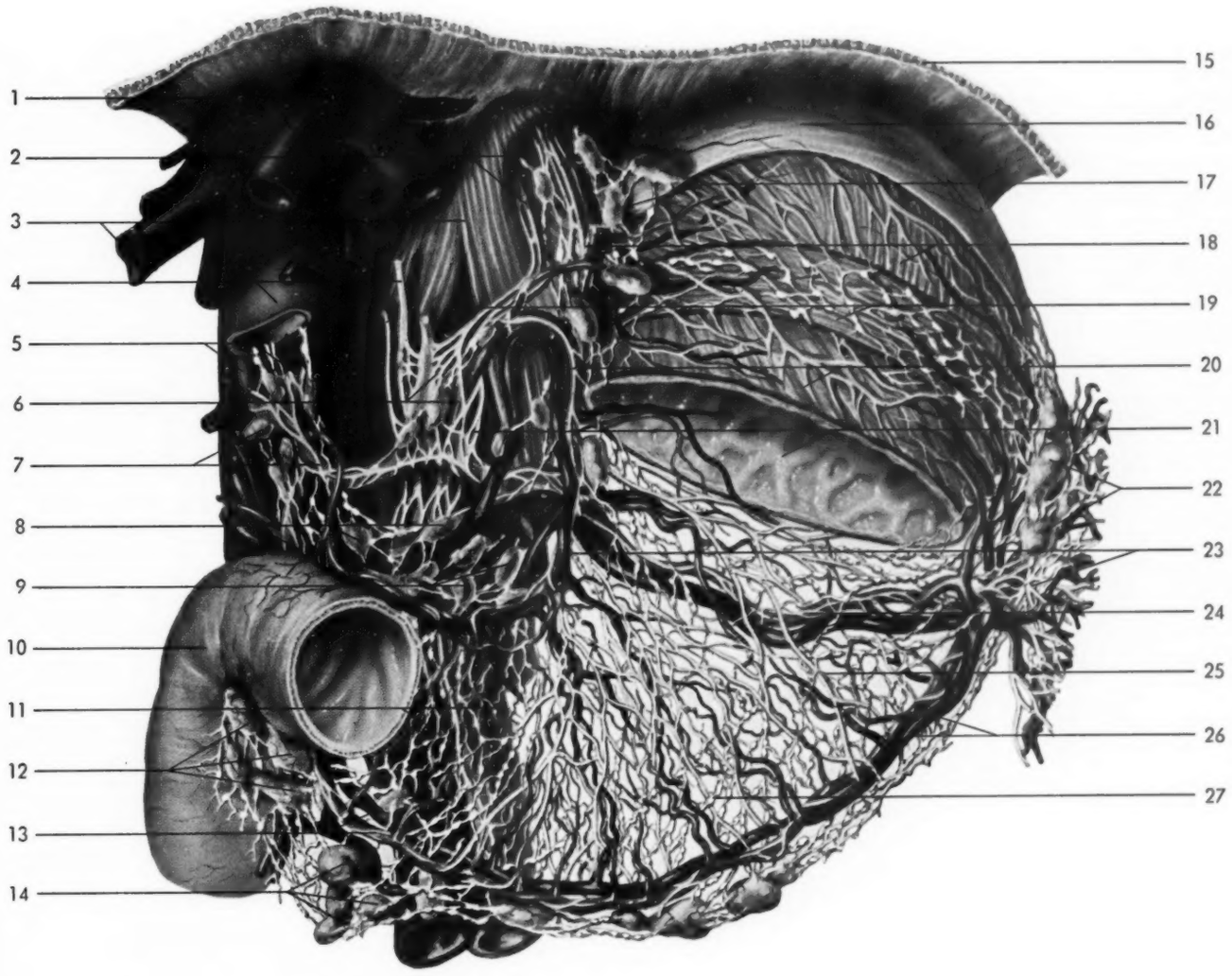
Anatomy *of the* Stomach



1 Middle and left hepatic veins

2 Right vagus nerve and esophagus

3 Right hepatic vein and crura of diaphragm

4 Inferior vena cava and greater splanchnic nerve

5 Portal vein and hepatic artery

6 Celiac plexus and celiac artery

7 Hepatic lymph node and hepatic rami of vagus nerve

8 Gastroduodenal artery and suprapyloric lymph nodes

9 Superior gastric lymph nodes

10 Duodenum

11 Superior mesenteric artery and vein

12 Subpyloric lymph nodes

13 Right gastroepiploic artery and vein

14 Inferior gastric lymph nodes

15 Diaphragm

16 Serosa

17 Paracardial lymph nodes

18 Left vagus nerve and longitudinal muscular layer

19 Abdominal aorta and circular muscular layer

20 Left gastric artery and oblique muscular layer

21 Celiac rami of vagus nerve and gastric mucosa

22 Splenic lymph nodes

23 Left gastric (coronary) vein and splenic rami of vagus nerve

24 Splenic artery and vein

25 Gastric rami of vagus nerve

26 Left gastroepiploic artery and vein

27 Gastric lymphatic plexus

This is one of a series of paintings for Lederle by Paul Peck, illustrating the anatomy of various organs and tissues of the body which are frequently attacked by infection, where aureomycin may prove useful.

Lederle

In perforated viscus,

in elective surgery of the stomach,

as well as for

gastroenteric infections–

Aureomycin

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often acts promptly to prevent

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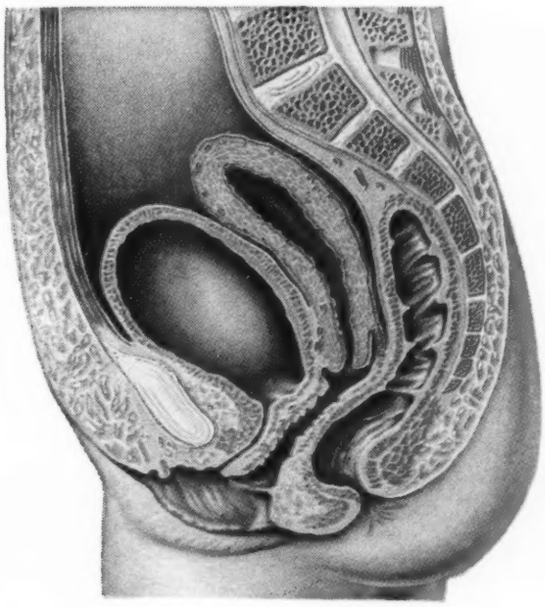
Preventing Postpartum Urinary Retention



In a recent study,[1] the prophylactic administration of URECHOLINE to 129 postpartum patients reduced the incidence of urinary retention from a previously reported 13.8 to 2.3 per cent. Therapeutic use of the drug successfully relieved acute urinary retention in 46 per cent of 73 cases.

[1] Fleming, A. R.: *Am. J. Obst. & Gyn.* **64**: 134, 1952

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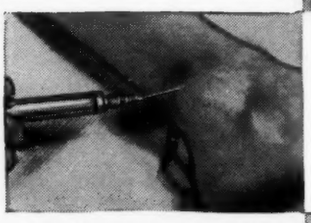
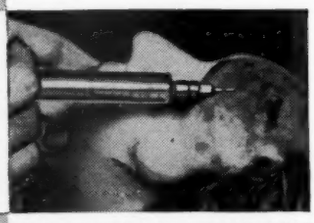
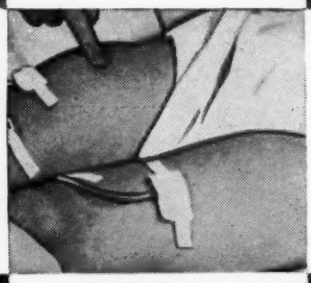


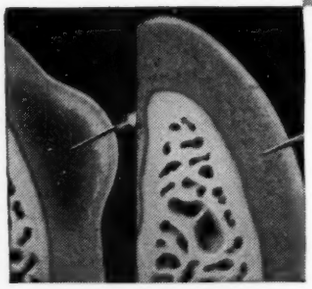
TREATMENT OF SPRAINS



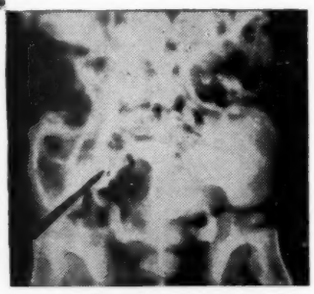
REDUCTION OF HEMATOMAS



HYPODERMOCLYSES



LOCAL ANESTHESIA



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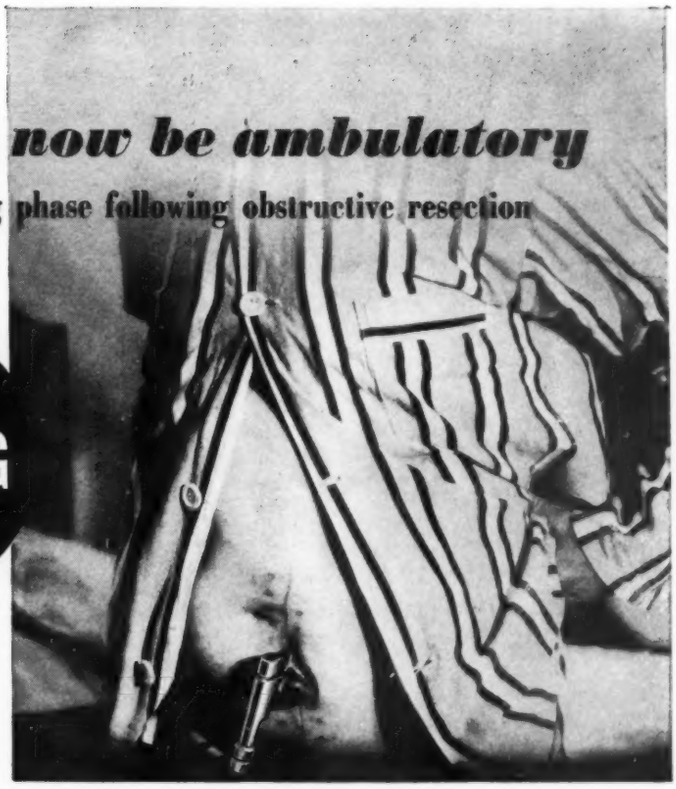
during spur-crushing phase following obstructive resection



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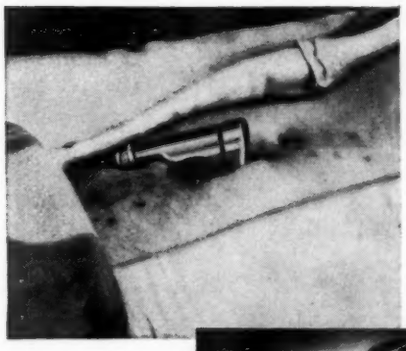

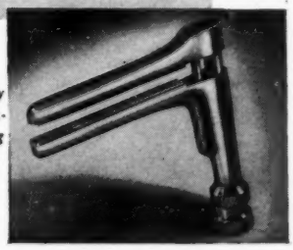

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* Surgery: Vol. 6, No. 3, 428-430, September 1939.

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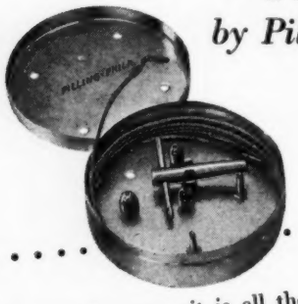

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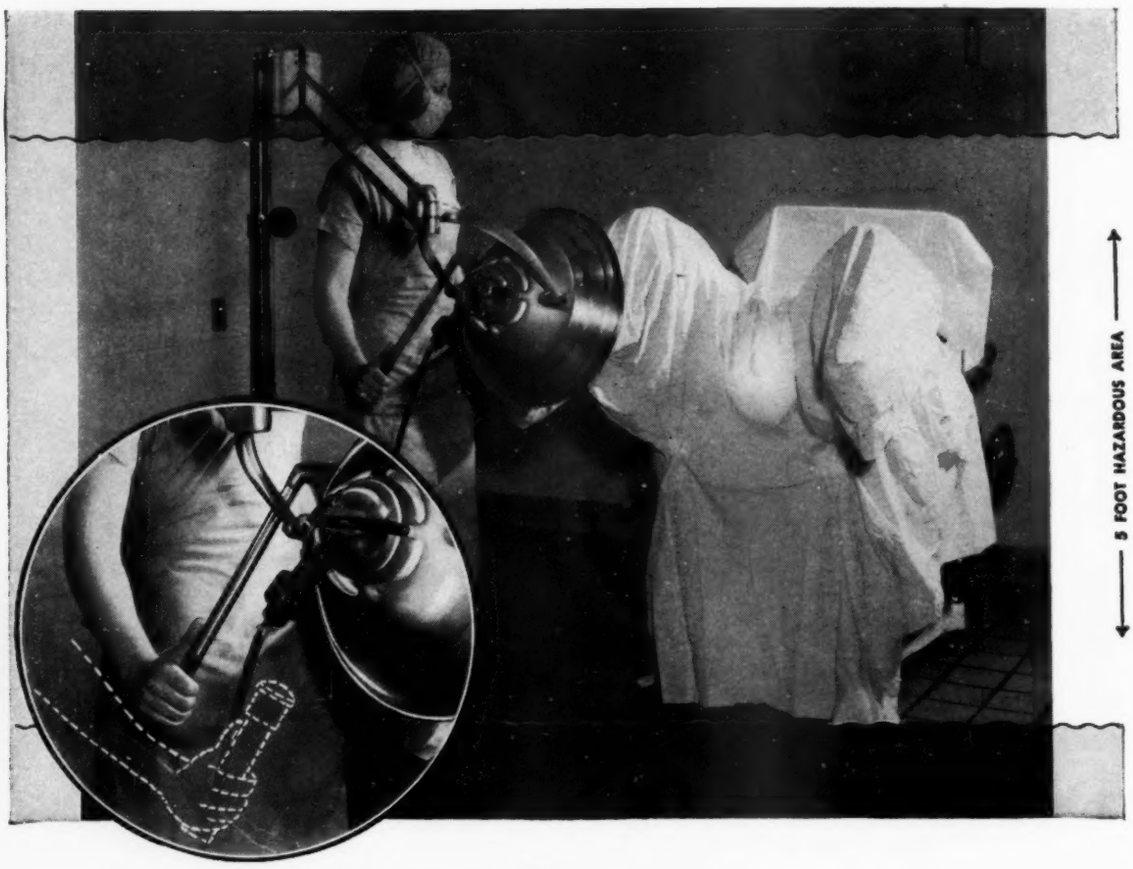

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1. A. W. Spittler, Col., (M.C.), U.S.A., J. J. Brennan, Lt. Col., (M.C.), U.S.A., J. W. Payne, Capt., U.S.A.F. (M.C.), American Academy of Orthopedic Surgeons, Jan. 26-31, 1952, Chicago, Illinois.
2. M. C. Cobey, M.D., F.A.C.S., Professor of Orthopedic Surgery, Georgetown University and Senior Attending Orthopedic Surgeon, Children's Hospital, Washington, D.C., The American Surgeon, Vol. XVIII, No. 4, April, 1952, pp. 413, 415.
3. M. C. Cobey, M.D., F.A.C.S., Washington, D.C., private communication.

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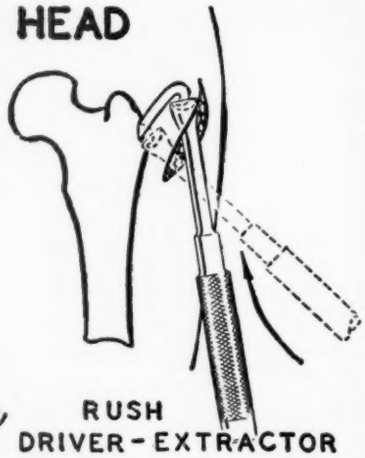

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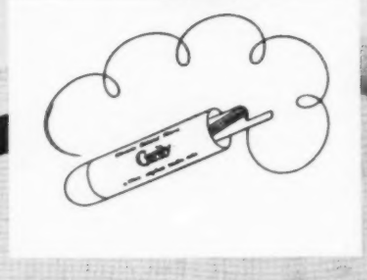

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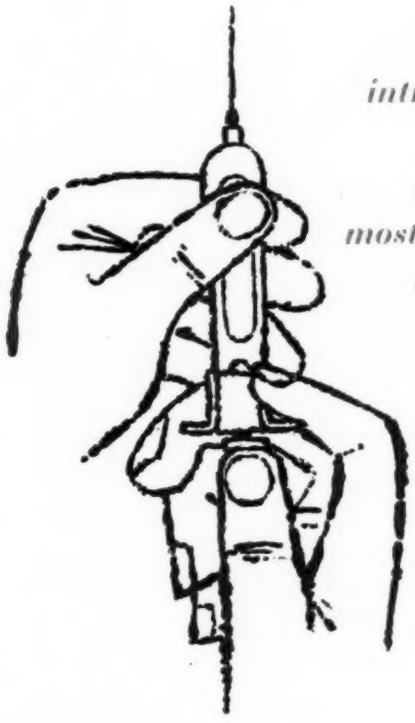

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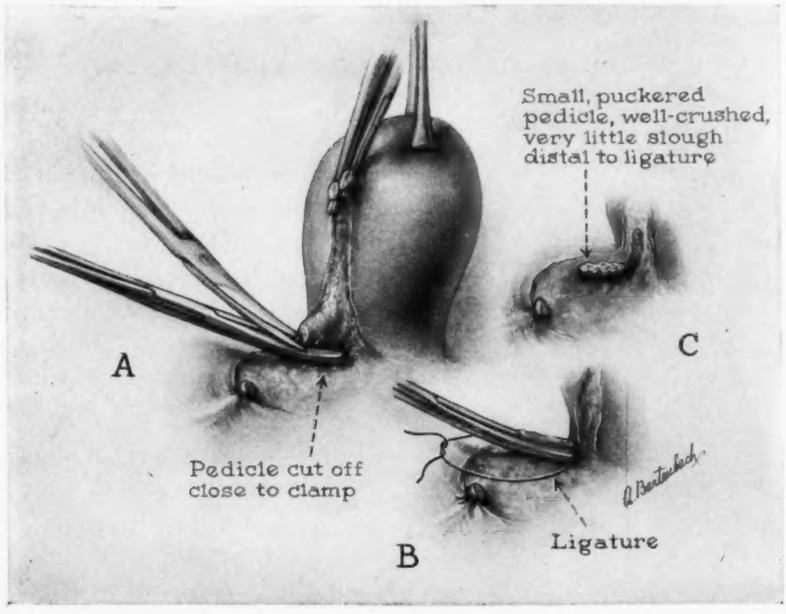

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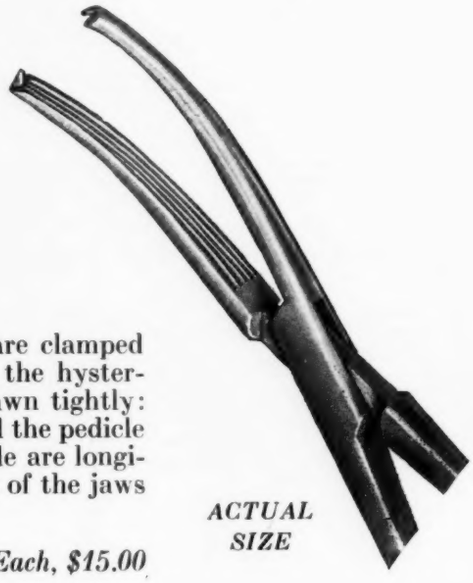

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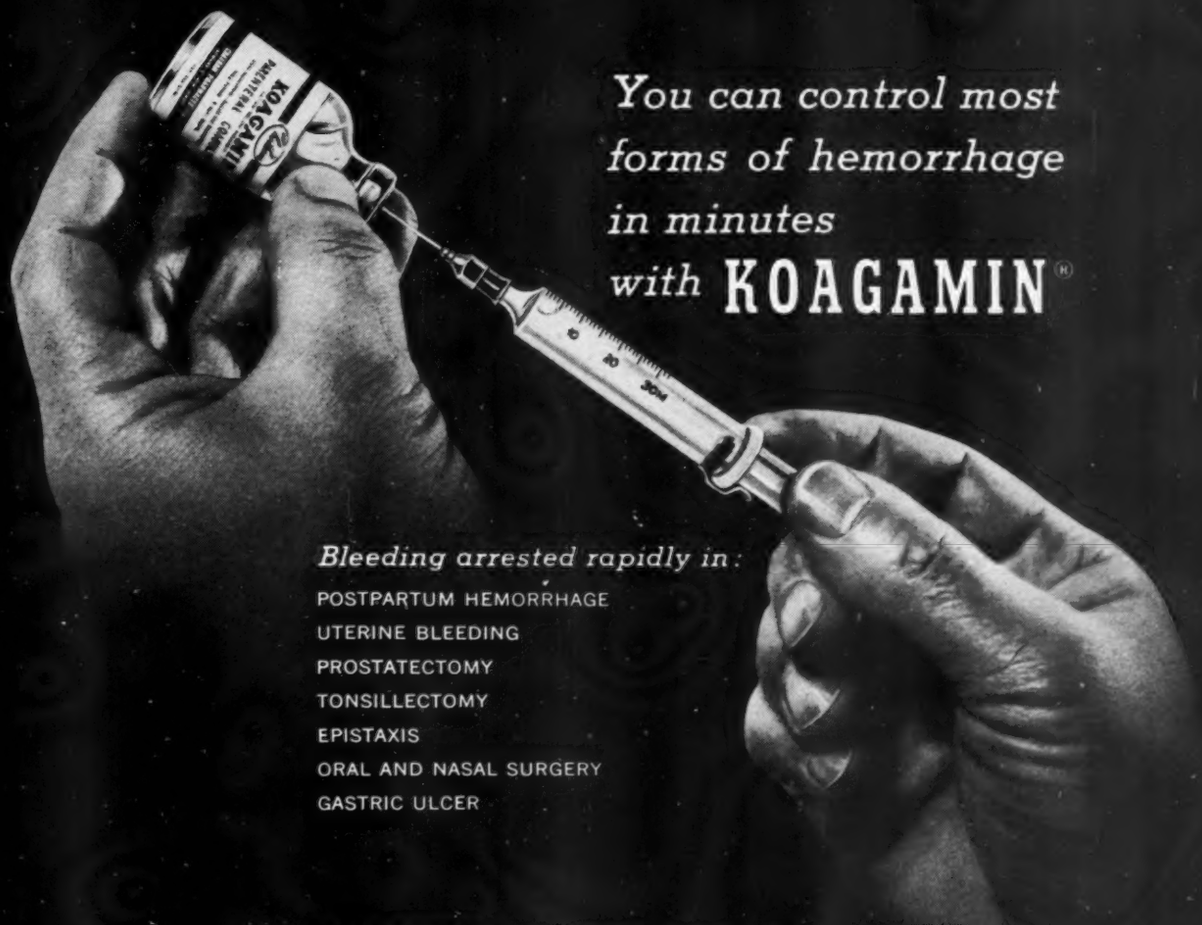

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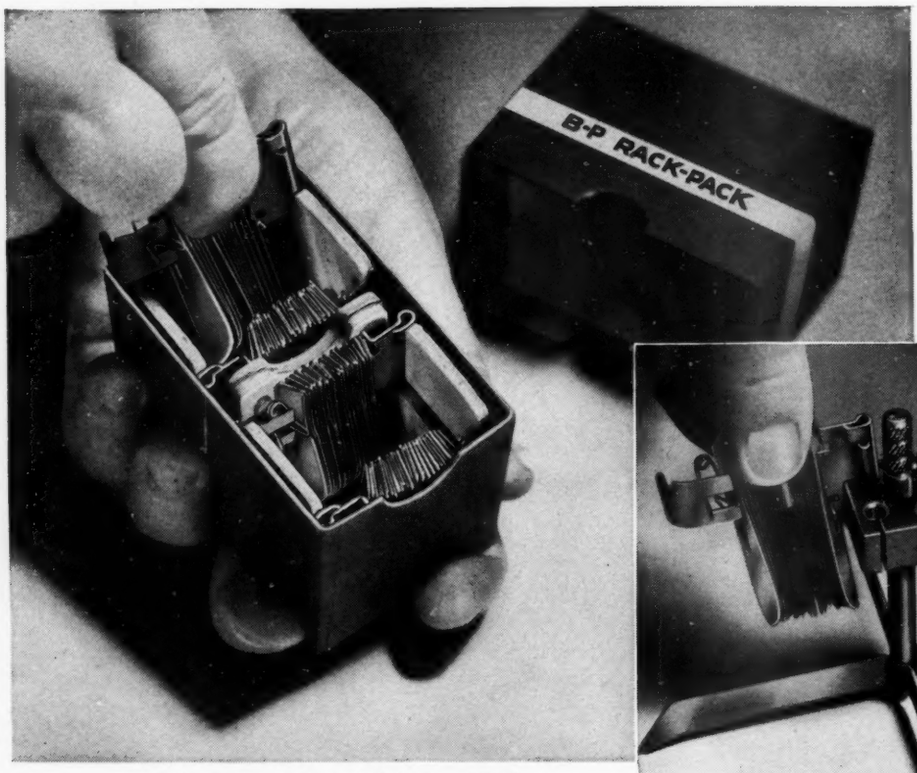

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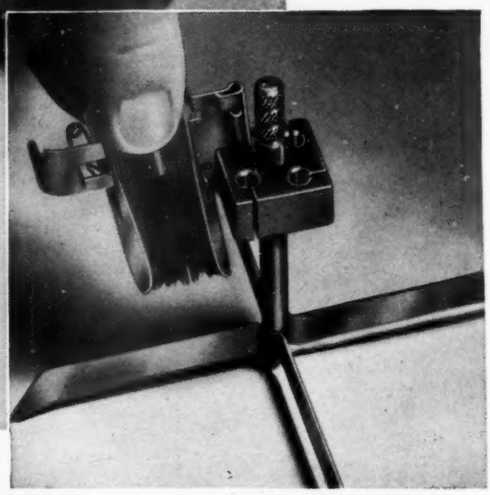

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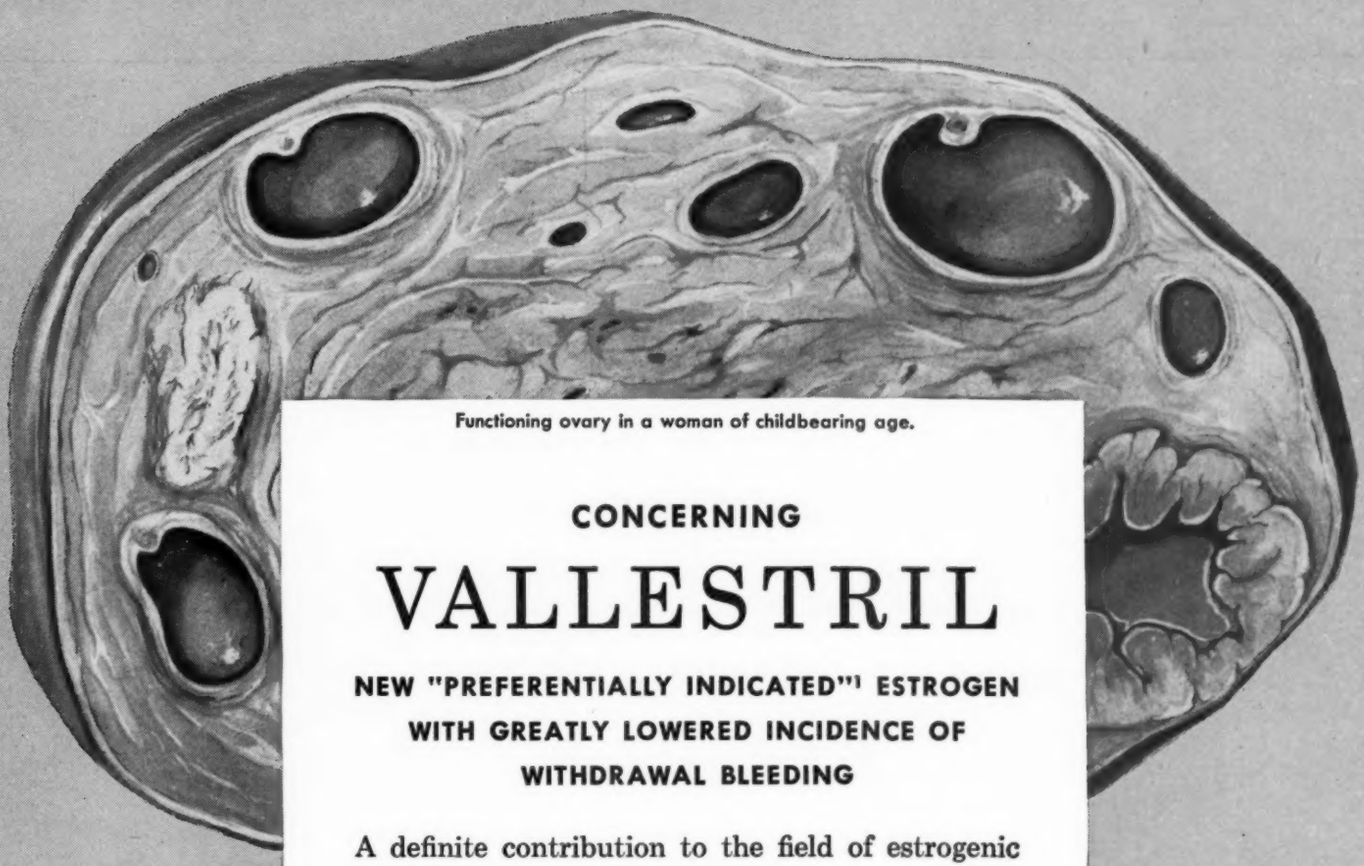

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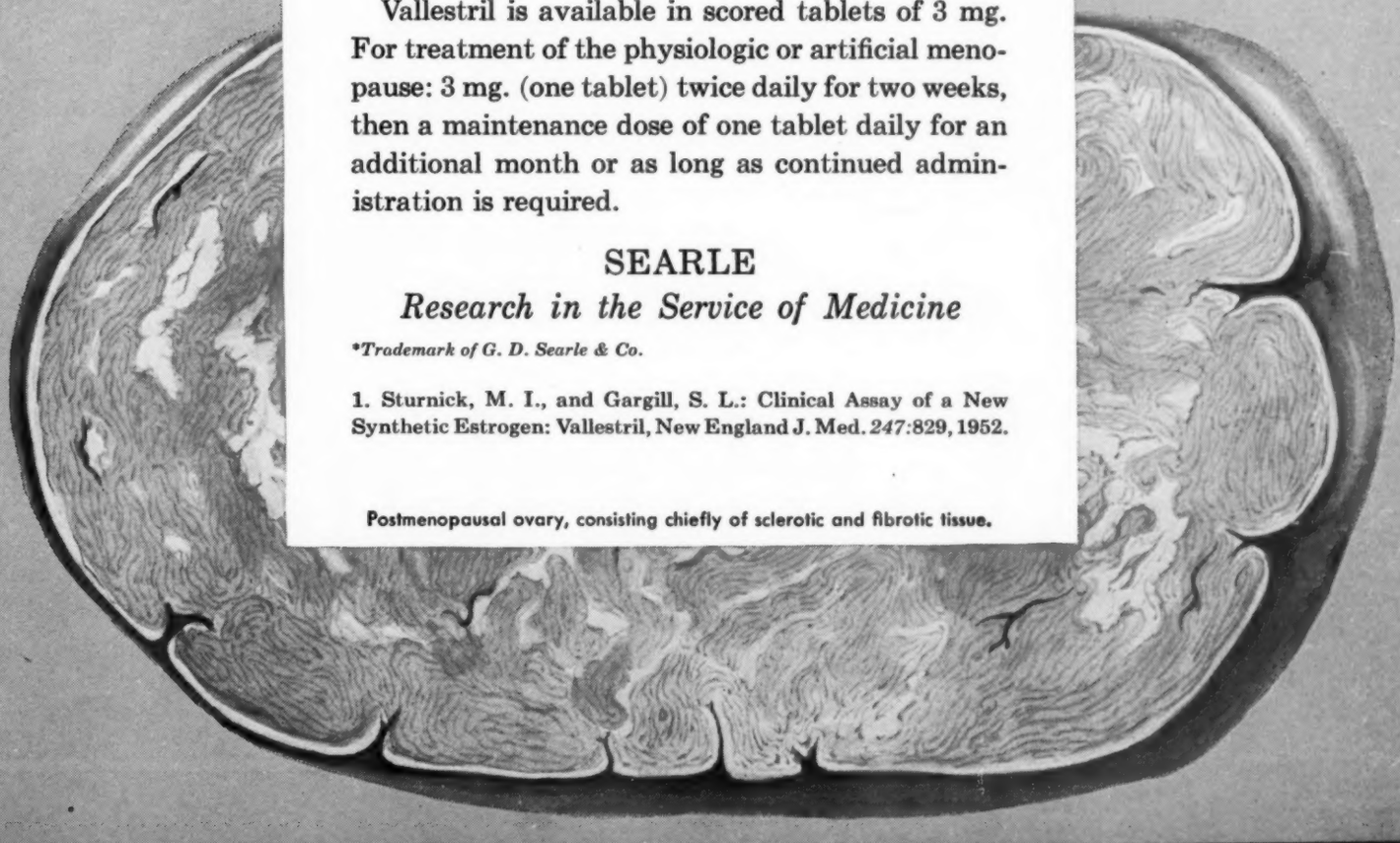

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Editorial

MAXILLOFACIAL SURGERY*

SURGERY of the face and jaws was in America, as in most countries, the ground in which plastic surgery had its beginning. As the specialty developed, the importance of surgery of the jaw was early de-emphasized. The pendulum swung with a wide neglect of the facial region as the principles of reconstruction were offered to the problems of the hand, breast and genitals. The return swing would seem to have begun and maxillofacial surgery is again in the professional eye as a large and important part of plastic surgery.

Fractures of the facial bones, traumatic injuries to their associated soft tissues, congenital deformities of ears, nose, mouth and jaws, the problems of cancer cure and reconstruction, skin grafts and tissue shifts, and disorders of the temporomandibular joint all provide ample material for a lifetime's work of special interest. There is also scope for gratifying liaisons and cooperation with other specialties. The otolaryngologist, so preoccupied with the difficult workings of middle and inner ear, nasal passages, sinuses, pharynx and larynx, is only too ready to seek the help of those familiar with the principles of tissue shifting and grafting to reconstruct the coverings of his precincts. Busy with optics, conjunctiva and the vagaries of eyeball and muscles, the ophthalmologist welcomes help in reconstruction of orbital margins and eyelids. Treatment of jaw fractures and disorders of the temporomandibular joint are by definition problems of orthopedics, but where is the orthopedic surgeon who is not too busy with the multiple problems of other bones and joints to learn the implications and intricacies of dentofacial orthopedics? The exodontist, oral surgeon, orthodontist, neurologist, neurosurgeon and even the dermatologist all have problems in which they welcome the help and advice of the maxillofacial surgeon.

Such a wide field necessitates full study and intensive training by those who are to undertake its practice. It is to be hoped that this training will be kept completely in line with the present requirements of specialty training. However, one wonders if the emphasis on general surgical training, admittedly so important, has not gone far enough and if the incumbent trainee in plastic maxillofacial surgery might not be given ample credit for time spent in familiarizing himself with the physiology and function of the mouth, with dentistry in whole or in part, with otolaryngology and ophthalmology, orthopedics, etc. These are part of a general understanding of surgical problems of the body and more pertinent to the training at issue than, say, a knowledge of the relative merits of Bilroth I or Bilroth II in gastric surgery.

There is indication for help in undergraduate medical education. Additions to the overcrowded medical curriculum are impossible, yet educators are continually reviewing schedules and seeking a better balance of their context.

* This editorial introduces a Symposium on Maxillofacial Surgery consisting of several papers read at the annual meeting of the American Society of Maxillofacial Surgeons, September 10–13, 1952.

Might they not well turn to a careful selection of maxillofacial surgeons to contribute lecture demonstrations of such subjects as (1) congenital deformities of the face, (2) fractures of the facial bones and (3) the principles of tissue shifting and grafting? They would thus provide their charges at graduation with a passing knowledge of some fairly fundamental principles presently overlooked in many of our schools.

Maxillofacial surgery, whether by preference confining its efforts to this field or taking broader scope in general plastic surgery, is established and here to stay. There are implications of training and teaching, both for members of the specialty and by them of the undergraduate. It is a welcome and useful adjunct to medicine's obligation to the diseased, deformed or injured person.

JOHN W. GERRIE, M.D., C.M., D.D.S.

Symposium on Maxillofacial Surgery

CONSIDERATION OF SOME NON-MALIGNANT DERMATOLOGIC CONDITIONS

WALTER R. NICKEL, M.D.
San Diego, California

IT is my intent to discuss some of the more common skin manifestations of interest to maxillofacial surgeons. Some of the terminology may be new but as specialists familiarity with the commonplace is demanded. I had planned to begin with a discussion of the non-malignant pigmentary disorders of melanogenic type. With the apparent confusion which I have encountered on all sides by the use of such terms as lentigo, junction nevus, active junction nevus, malignant melanoma *in situ*, etc., I believe that I, too, should briefly state my opinion.

When the pathologist himself admits that there are no "hard and fast" criteria in all cases for the diagnosis of malignant melanoma or nevo carcinoma, which ever you prefer to call it, I maintain that clinical judgment must be a strong consideration. This is all the more true in those cases with a questionable pathologic diagnosis.

Before Pack's[1] article most men of my acquaintance, with vast experience, believed that once an unequivocal diagnosis of malignant melanoma had been made the prognosis was fatal. At that time this was an uncommon diagnosis. Today, however, it seems to be made more frequently. One asks, is it the disease or the diagnosis that is on the increase? I consider the latter to be the case. Because of a desire for the security of group opinion and the legal protection afforded the clinician, the custom today is to send all bits of tissue to the laboratory for microscopic examination. This custom, coupled with widespread group health insurance plans which defray the cost of laboratory tests, has resulted in more pigmented lesions being examined microscopically.

Only recently have general pathologists shown any interest in dermal pathology beyond the diagnosis of chronic dermatitis or chronic inflammation. As a result we have for years assiduously studied and taught dermal histopathology to other dermatologists and of late to some general pathologists.

Some of the changes in the melanoblasts, clear cells of Masson and junctional activity as evidenced by theque formation with which dermatologists have been familiar are being seen more frequently by the general pathologist. Many of these benign lesions are being interpreted as active junction nevi, malignant melanoma *in situ*, both "fence-straddling" terms, and some are even reported as malignant melanoma. To make an honest mistake in calling a malignant lesion benign is no reason to call all questionable future lesions malignant just to "play it safe," and especially so in view of the extreme radical surgery which that diagnosis forces on the patient. The more frequently experienced pathologists see pigmented nevi and suspected malignant melanoma, the more often they freely admit their inability to make a "cut and dried" diagnosis in all cases.

This is especially well illustrated when they look at nevi removed from the prepubescent child. Here the term juvenile melanoma is used to describe a microscopically malignant lesion with a clinically benign course in most instances.

Benign Pigmentary Lesions. A freckle or ephelis is the most common type of transitory pigmentary deposit. It is not significant in this discussion. Permanent freckles or lentigenes are a different problem. Occasionally, those occurring on the exposed surfaces in older people may be the precursors of a senile keratoses but as a rule require no treatment. Along with several other conditions showing pigment changes, the public refers to these as "liver spots."

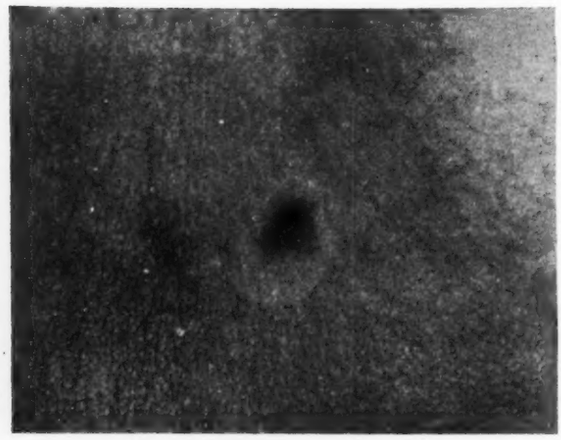

FIG. 1. Halo nevus of shoulder.

Lentigo appearing on the vermilion portion of the lower lip is fairly common. I have never heard of any of these lesions undergoing malignant change and most dermatologists consider them as cosmetic problems only and as such recommend surgical excision. Microscopically the pigment is confined to the basal cell layer. Before considering other pigmented lesions permit me to redefine an old term, nevus or nevoid. As dermatologists we do not confine the term nevus to pigmented nevi alone, and properly so. A nevus is a "mole or birth mark: a general term for circumscribed new growths of the skin of congenital origin which may be either vascular, i.e., due to hypertrophy of blood or lymph vessels, or non vascular, i.e., with epidermal and connective tissue predominating." Therefore, it is not improper to refer to sebaceous nevus, vascular nevus, epidermal nevus and the like.

The term junction nevus is heard often in these days. For many years it has been stated that at least 90 per cent of all pigmented nevi show junctional activity at some stage in their development. On serial section, even in adults, more than 80 per cent still show this feature. This is microscopically manifest as a nesting of pigment-forming cells at the dermal epidermal junction, hence the term junction nevus. Whether these nests drop down into the dermis as first theorized or whether succeeding nests pile on top of one another is an academic point. It is much more important that the alarm is not sounded each time a diagnosis of junction nevus is made, and that an attempt be made to develop a more concrete set of criteria for differentiating those nevi showing enough junctional activity to be considered malignant.

Junction nevi that might cause concern clinically are usually flat and dark in color. It is my conviction that all pigmented lesions of the palms, soles, sides of the fingers and anywhere on the feet should be surgically excised.

Ordinary pigmented nevi of any great extent covering large body surfaces and usually hairy can be treated only by plastic surgery. In the discussion of a case of extensive hairy bathing trunk nevus, at the Los Angeles Dermatologic Society recently, the point was made that almost always these lesions undergo malignant degeneration. Although uncommon, surgical intervention when possible is always indicated.

Figure 1 shows a variant of the ordinary pigmented mole. With the zone of depigmentation around the lesion it is only natural that this be referred to as a "halo nevus." These lesions are especially interesting because a high percentage disappear spontaneously. This indicates a line of investigation for therapy.

The blue nevus of Jadassohn varies from the foregoing in that we have always considered these to arise from dermal melanoblasts, whereas the ordinary pigmented nevi arise from epidermal melanoblasts. This concept may be altered by the work of Dr. Thomas Fitzpatrick and Dr. Samuel Becker, Jr., both of whom worked on this problem while fellows at the Mayo Clinic. The potential malignant nature of this lesion is questionable. I do not know of a single instance of a blue nevus of Jadassohn ever undergoing malignant change.

The Mongolian spot composed of morphologically the same cell as the blue nevus is usually found over the sacrum. It has been reported as an aberrant finding in other skin areas however. These lesions likewise tend to disappear spontaneously.

It is always striking to see a case of xeroderma pigmentosum. We consider this a familial, congenital condition and by the definition of the term it is a nevoid. The case described is an example of the combined efforts of the plastic surgeon and the dermatologist. When we understand the fundamental photosensitive nature of these patients' skin, we know that x-ray and radium have no part in their therapy. We have kept this girl alive beyond what is normally considered her life span. The dermatologists have removed upward of 300 carcinomas from her skin by desiccation and curettement in the past seven years. Invading malignant lesions of the nose

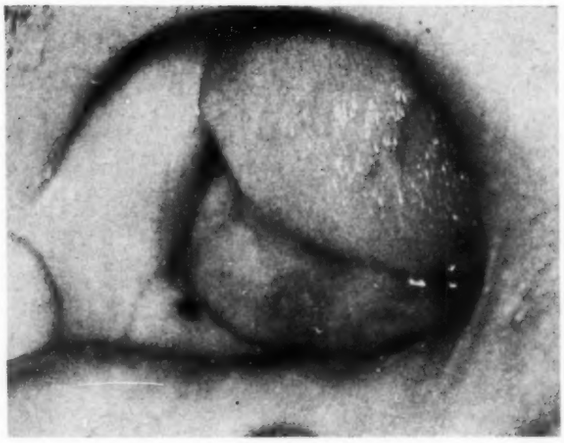

FIG. 2. Amalgum tattoo, localized argyria, lower alveolar ridge.

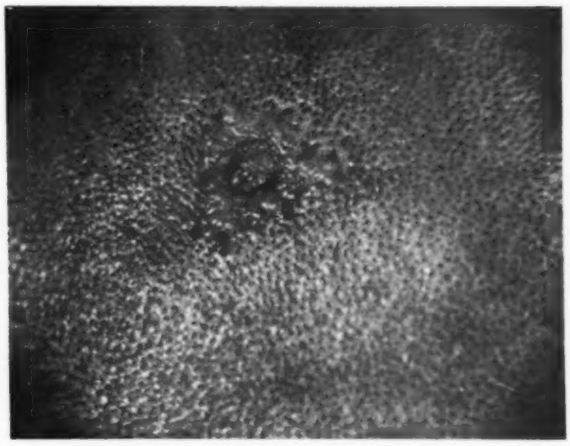

FIG. 3. Sebaceous nevus degenerating into a basal cell carcinoma (scalp).

were removed by the plastic surgeon. I am sure that the remaining eye which this patient still has is there because a very early conjunctival lesion was recognized and removed without disturbing her vision. Enucleation of the other eye fifteen years ago was performed for squamous cell carcinoma. Usually these people die early from metastic squamous cell carcinoma.

Captain Bell and I[2] were interested in the deeply pigmented lesion shown on the rim of the lower alveolar ridge. (Fig. 2.) With a knowledge of dental training it is recognized immediately as amalgum tattoo or localized argyria. The only reference found in the literature was by Max Joseph[3] in 1906. He described staining of elastic fibers and pigmentary changes in silver workers. This change is due to the accidental implantation of silver into tissue. From a review of the histories of our two cases, one of Dr. J. Walter Wilson of Los Angeles, and our work with rabbits, I am sure that it takes years for the silver finally to stain the tissue. The man in the photograph (Fig. 2) had been edentulous for eighteen years. Clinically and microscopically the amalgum tattoo resembles blue nevus.

Accidental implantation of carbon into the skin produces a tattoo; this is common among coal miners. Pigmented streaks of the face can result from what appears to be minor abrasions which are not properly treated at the time of the accident.

Purposeful tattoo is usually best treated by surgery. Recently a young woman reported with a small cross tattooed on her forehead. This had been done by members of a gang with india ink and represented the mark of a "pack" which were gangs organized in high schools during the recent war.

Lesions of Sebaceous Gland. The plastic surgeon will be consulted because of a birth mark with a yellow color, usually on the face or scalp. Again we must go back to the term nevus, in this case sebaceous nevus. The predominant tissue is that of an overgrowth of sebaceous glands. I have seen microscopic sections showing a predominance of sebaceous elements in one portion, ordinary pigmented nevus cells interspersed with theque formation, and elements of hemangioma all in the same lesion.

Figure 3 shows a degeneration into early basal cell carcinoma in a pre-existing relatively flat sebaceous nevus. It is my impression that a high incidence of basal cell carcinoma can be expected in the ordinary sebaceous nevus if it is not removed.

Various types of adenoma sebaceum are described. The patient shown in Figure 4 has a father who has this condition, two uncles, two brothers, one sister and a daughter, all of whom show this skin picture, with hundreds of small skin tumors. Some varieties of adenoma sebaceum show ocular changes, mental deficiency and epilepsy in addition to the skin tumors.

Microscopically the tumor masses show overgrowth of sebaceous elements, cysts and deep-staining cell nests which are indistinguishable from the basal cell carcinoma. This merely points up the earlier statement relative to the limitations of microscopic diagnosis and the danger of accepting the "pink slip" diag-

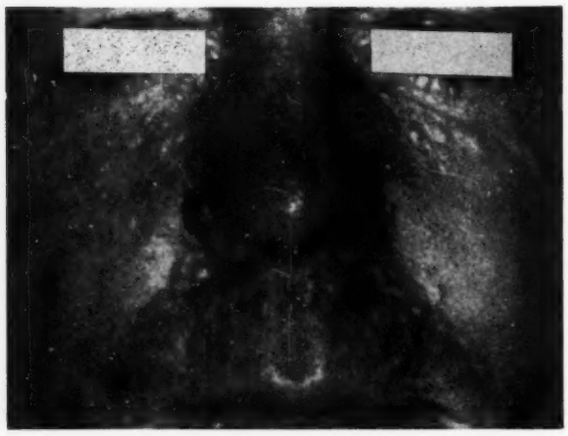

FIG. 4. Adenoma sebaceum.

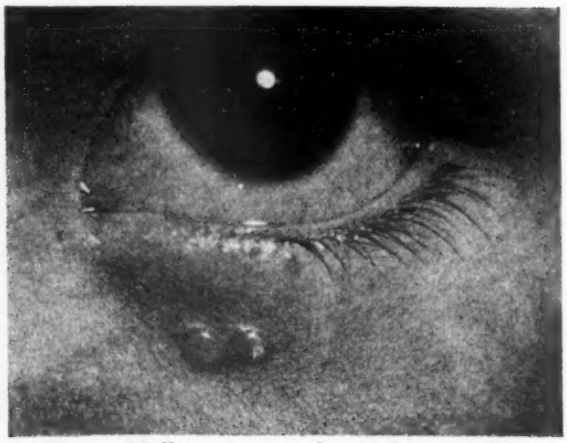

FIG. 5. Molluscum contagiosum, lower eyelid.

nosis without considering the clinical picture, the known clinical course and the heredity of the disease.

On the other hand senile sebaceous adenoma are acquired lesions and bear no relationship to the foregoing. These are sometimes clinically diagnosed as early basal cell carcinoma because of their color and localization. Microscopically they show an overgrowth of sebaceous glands in a small localized mass.

Epidermal Lesions. Congenital nevoid changes in the skin which are microscopically limited to the epidermis have been referred to as linear nevi, ichthyosis hystrix, epidermic hard nevi, epithelial nevi, etc. I prefer the term epidermal nevus. Most of these, if treated at all, yield best to plastic surgery. Here again because of the deep staining of the rete pegs they are erroneously diagnosed as basal cell carcinoma even by eminent histopathologists. Certainly their course treated or untreated is not that of cancer. Once established they remain unchanged.

Virus Infections and Benign New Growths. Virus infections of the skin are of interest to all specialities. The warts lend themselves to a wide variety of therapy. Molluscum contagiosum is sometimes erroneously removed as basal cell carcinoma. This is especially true when there is a solitary lesion present for several years. The lesion shown on the eyelid illustrates how such an error could occur. (Fig. 5.)

Keloids following infection or trauma are the garden variety of your practice. The value of postsurgical x-ray therapy must be stressed. It has long been the practice of surgeons to have their patients massage scars to keep them from binding down to the underlying skin. We as dermatologists contend that this enhances keloid formation. We see examples of patients producing large hideous keloids from constantly manipulating a small scar.

Granulomas. From a surgical standpoint beryllium granuloma which lends itself to surgical treatment only is almost indistinguishable, clinically and microscopically, from sarcoid of Boeck which is non-surgical. I have been informed that beryllium is no longer used in fluorescent light bulbs but thousands of old bulbs will be in service for years to come. Except for residual scarring surgical treatment of actinomycosis, scrofuloderma and blastomycosis has largely been replaced by internal therapy with antibiotics and other drugs. Recently Curtis[4] reported successful treatment of blastomycosis with stilbamidine.

Pyogenic granuloma is effectively and simply treated by desiccation, if done sufficiently deep to destroy the vascular masses beneath the skin.

The occurrence of paraffinoma or paraffin granuloma is on the decline. It has been observed following paraffin injection for hemiatrophy of the face. This sometimes occurs in scleroderma. In correspondence with Dr. Paul A. O'Leary of the Mayo Clinic it was learned that two cases have been treated using full thickness grafts with fat included, resulting in fairly good cosmetic result in hemiatrophy due to scleroderma. With so many drugs being given in fatty substances by deep injection we may in time see many fat or lipoid granulomas in the buttock and arms.

Two thoughts occur regarding the method adopted by plastic surgeons of using sand

paper to decrease the scarring of old, "burned out" acne: (1) the possibility of widespread keloid formation; and (2) the possibility of later formation of silica granulomas. In its microscopic appearance silica granuloma is similar to the beryllium granuloma, sarcoid, leprosy and certain types of syphilis and tuberculosis. If this method came into general use, I am sure one or both of these complications would be observed.

Pyodermas. Following severe cystic acne with resultant scarring, and pyoderma gangrenosa associated with ulcerative colitis, the skills of the plastic surgeon are demanded. In each case complete quiescence of the active disease for several months before any definative treatment is undertaken, must be the rule.

Rhinophyma which sometimes follows a severe acne rosacea has been established as an entirely surgical problem.

Carbuncles are no longer a plastic problem since antibiotics have been discovered. However, many of the existing scars from earlier day surgical management can be improved upon.

Radiation. X-ray and radium changes in the skin usually are those of chronic repeated injury. In the severe case much time could be saved and possible malignancy prevented if plastic procedures were employed early in the process. By the same token late in the disease much extensive plastic surgery could be postponed or prevented by dermatologic desiccation and curettement of the keratotic lesions before they undergo malignant change. I have never been able to understand some surgeons' advice merely to observe the premalignant keratotic lesions when we realize that a very high percentage will become malignant prickle cell carcinomas. Acute radiation effect was observed occurring in a dental technician who steadied the cone of the x-ray machine with her hand while taking pictures. It took two and a half weeks of daily exposure in a busy office to have the original erythema become noticeable. The bullous formation occurred at about four weeks.

Vascular Lesions. No method of therapy in nevus flammeus or port wine stain is satisfactory. We are happy that some of these cases lend themselves to satisfactory plastic repair. Strawberry angioma is successfully treated by various methods including plastic surgery, dry ice, injection, radiation, etc. The present tendency seems to be away from the use of radium.

Nevus araneus or spider angioma need only the desiccation needle as do superficial telangectases.

The acquired hemangioma of the lip which when opened seems to "pop out" usually follows trauma. Because of their color they are sometimes confused with a melanotic tumor clinically.

Oral Lesions. Several different diseases present leukoplakic areas on mucous membranes, other than leukoplakia itself. Among the common ones are lichen planus which can be confusing unless lesions are seen elsewhere on the skin or unless the pattern on the buccal mucosa is characteristically reticulated. The changes over an ordinary wart or papilloma or neurofibroma in the mouth are clinically and microscopically leukoplakic in the epidermis. Transitory benign plaques of the tongue have temporary leukoplakic changes.

Probably the most exotic leukoplakic change in the whole group is the appearance of white mucous membranes of the mouth in a very rare condition appearing in childhood and described under the term white sponge nevus. This has been described as a familial characteristic and is extremely rare.

Sutton[5] described a fairly common condition, granuloma fissuratum presenting a leukoplakic-appearing, button-like lesion with fissure in the center. These lesions occur at the anterior labial alveolar fold and do not disappear unless destroyed. Microscopically there is inflammation and new blood vessel formation.

In considering the lips the usual differential diagnosis between warts, syphilitic chancre and cancer are always stimulating.

As a final group let us consider certain conditions that deserve little more than honorable mention: neurofibromatosis which is a surgical problem; xanthelasma which tend to recur following any method of removal; lupus erythematosis of the discoid type which is not a surgical problem but which you will certainly be asked to treat; porokeratosis (Mibelli) a very chronic keratotic lesion which could be confused with senile keratosis microscopically.

A group of conditions arising from apocrine sweat glands the first two of which are sometimes reported as basal cell carcinomas but

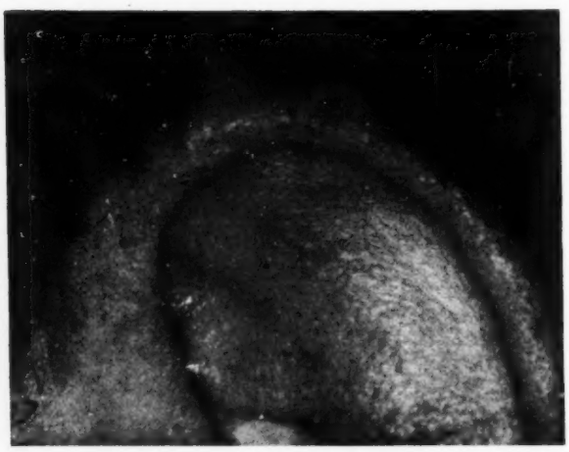

FIG. 6. Chondrodermatitis nodularis chronica helicis (ear).

are not clinically malignant: (1) Nevus syringadenomatosus papilliferus which arises from the ductal portion of apocrine gland. (2) Hydroadenoma papilliferum which arises from the acinar portion of the apocrine gland. (3) Cysts of the sweat glands occurring characteristically at the outer canthus of the eye; usually multilocular and arising from the acinar portion of the apocrine gland. (4) Hidradenitis suppurativa, an inflammatory process in these glands occurring in axilla, groin, buttock, neck and scalp. This is usually considered a furunculosis until it fails to respond. Those which do not resolve with antibiotics and x-ray therapy require plastic surgery.

Chondrodermatitis nodularis chronica helicis (Fig. 6) or chondroma dolorosa, tends to recur at either end of the excisional scar. Lastly when considering cysts or darwinian tubercules on the ears, remember gouty tophi.

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CYSTS OF THE THYROGLOSSAL DUCT

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THE purpose of this article is not to offer anything new but to review a subject that bears repetition. I chose to discuss cyst of the thyroglossal duct because it presents an interesting diagnostic and surgical problem, and because many of the patients that we are called to operate upon have had surgery once or twice previously. In the series of cases from the Massachusetts Eye and Ear Infirmary and the Massachusetts General Hospital reported by Nachlas,[1] one patient had been operated upon seven times before complete cure was obtained.

The subject of thyroglossal duct cysts should interest maxillofacial surgeons also in relation to our particular field of surgery. We will frequently be required to repair defects arising from infection and surgery. In addition, the upper end of the thyroglossal duct terminates in the middle of our chief operative area.

The thyroid gland is formed by an evagination in the floor of the primitive pharynx that extends down the midline to the level of the second tracheal ring. This evagination develops into a tube lined with columnar epithelium that eventually forms the pyramidal lobe, isthmus and lobes of the thyroid. Normally, the tube then obliterates, with the foramen cecum at the base of the tongue as the sole remnant.

The thyroglossal tube develops before the formation of the hyoid bone, so that when the hyoid is formed the thyroglossal tube passes either through the hyoid at its center or in a notch posterior to the hyoid. Occasionally the tube does not obliterate. When this occurs, there is a remnant lined with epithelium extending from the foramen cecum to the pyramidal lobe of the thyroid gland. The by-products of epithelial metabolism accumulate and ultimately a cyst evolves. This cyst may become evident any time from birth to old age. Its presence depends on (1) the rate of secretion of the tract lining, (2) spontaneous drainage through the foramen cecum and (3) occurrence of infection in the sac.

In the first instance a swelling occurs in the neck, 79 per cent midline and 21 per cent laterally,[1] anywhere from the submental space to the lower end of the thyroid cartilage. This swelling may be stationary or gradually increase in size. In the second instance, when the foramen cecum is patent, the swelling may come and go. When infection intervenes, as in the third instance, the signs of acute inflammation are present. Infection occurs most often in conjunction with acute respiratory infection. The inflammation may subside spontaneously or with the aid of aspiration and antibiotics. It may require incision if these measures fail. If incision is necessary, the wound may heal, leaving a dimpling at the site of incision or a persistent sinus that seals and drains at intervals.

A cyst may occur at any location along the tract. We have had one case in which only the suprahyoid portion of the duct was patent, and a 5 cm. cyst was removed from the submental region with no connection to the infrahyoid portion of the tract. When the infrahyoid portion is cystic, the suprahyoid portion may be a tube or, in rare instance, may be absent. The infrahyoid portion of the tract forms a well developed cyst wall which is easy to dissect except when repeated infections have occurred. When this is the case, the infrahyoid portion may adhere to the surrounding structures. The suprahyoid portion is thin-walled, fragile and does not resist traction. Consequently, it is easy to fracture during dissection.

Diagnosis of thyroglossal cyst is not difficult when the swelling is in the midline because the mass elevates on swallowing or on protrusion of the tongue. The same is true when a sinus is present. When the mass is lateral, however, a differential diagnosis has to be made among cyst of the thyroglossal duct, tumor of the submaxillary and submental glands, cysts of the submental space, enlarged lymph glands and aberrant thyroid. Thyroglossal cysts are more medial than branchial cysts that generally lie just at the anterior border of the sternomastoid muscle. (Figs. 1 and 2.)

Preoperative differential diagnosis of thyro-

1 2

FIG. 1. Thyroglossal cyst sinus; tongue in normal position.

FIG. 2. Thyroglossal cyst sinus; tongue protruding, with elevation of the cyst and dimpling and retraction of the sinus.

glossal cyst is important because the suprahyoid portion must be removed in order to prevent recurrence. The tract leading from the cyst to the mid-portion of the hyoid can usually be palpated. If doubt exists, radiopaque material may be injected and a radiogram may be made that will show the tract. Acute inflammatory accumulations in the cyst should be incised if they do not subside spontaneously, and excision should follow after all inflammatory reaction has disappeared.

We follow the operative technic for thyroglossal cyst removal described by Sistrunk in 1920.[2] The technic is as follows: "A transverse incision, about two inches in length, is made across the neck at about the level of the hyoid bone and the skin and platysma muscle are reflected. The cyst will be found lying beneath the raphé connecting the sternohyoid muscles. It is dissected free from the surrounding tissues up to the hyoid bone. At this point, the tract usually passes through the hyoid bone, although it is sometimes found passing above or below it. We then separate the muscles attached to the center of the hyoid and remove a portion of the bone about one-fourth of an inch in length; then, without any attempt to isolate the duct, we core through the tissues from this point directly to the foramen cecum, removing with the duct the tissues surrounding it for a distance of about one-eighth of an inch on every side. In order to do this, it is necessary to know very accurately the direction that must be followed in order to reach the foramen cecum. This line corresponds to one drawn at an angle of forty-five degrees backward and upward through the intersection of lines drawn horizontal and perpendicular to the superior central portion of the hyoid bone. The dissection removes with the duct a portion of the hyoid bone, a portion of the raphé joining the mylohyoid muscles, a portion of each geniohyoglossus muscle, and the foramen cecum. The opening into the mouth is closed and several sutures are used to draw the geniohyoglossus muscles together; the tissues surrounding the cut ends of the hyoid bone are then brought together with chromic catgut sutures in such a manner as to approximate the edges of the bone. A small rubber tissue drain is introduced down to this point and the skin closed around it. It is probably best to inject sinuses with some dye, such as methylene blue, in order that any lateral branches, and these are occasionally found, which may be present between the hyoid bone and the foramen cecum may be recognized and removed."

Our modification of this technic occurs when dissection reaches the foramen cecum, recognizable because the mucous membrane that is continuous with the tract flares out at this point and has the appearance of the outside

of a funnel. We place a chromic catgut ligature here rather than suture. We then divide the tract from the lingual mucous membrane proximal to the ligature.

We make a transverse incision over the cyst. In case of a sinus we remove the sinus opening with a transverse elliptic incision, and we prefer to follow the contour of a crease when one is present. We make no attempt to suture the muscles or approximate the cut ends of the hyoid bone. We place a small Penrose drain in the wound that is allowed to remain for twenty-four hours. We use methylene blue in almost every case because it assists materially in avoiding the cyst wall above the hyoid. When infection has intervened, the infrahyoid portion may be adherent to the hyothyroid membrane. Care must be exercised to avoid perforating this membrane.

At our clinic we have observed forty-nine cases of congenital cysts of the neck. Nineteen patients had branchial cysts and underwent operation. Thirty patients had thyroglossal duct cysts, and of these eighteen were operated upon according to the procedure which we have discussed. The patients experienced no recurrence or complication following surgery. Two of our patients had lateral presentation of the cyst. The first one was diagnosed incorrectly and only the cyst was removed. A sinus persisted until the suprahyoid portion was removed. The second lateral cyst was diagnosed and treated correctly. In one of our recent cases papillary adenocarcinoma was found on microscopic section. There was no indication that this was a malignant cyst prior to the time of surgery. Radical thyroidectomy and neck dissection was performed at a later date. There has been no recurrence up to the present time.

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CONGENITAL ABSENCE OF THE RAMUS OF THE MANDIBLE

SUGGESTED FORM OF TREATMENT

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CONGENITAL absence of the ramus of the mandible is not an obscure condition; neither is it a disease entity. Whenever the condition is found, some associated congenital malformation is usually noted. Although only about twenty-four cases have been reported to date, which include the five reported by Kazanjian,[1] it is my conviction that many more cases have been seen and not reported. It does not take a diagnostic genius to recognize the condition, but in view of the fact that the treatment has been of a hopeless nature most men thought it of no theoretic or practical importance to report the cases.

I profess no new knowledge as to the etiology or ontology of the deformity. Aside from the fact that there is a pathologic situation in the first branchial arch and cleft, all theories are purely guesses.

The only comprehensive report to date that I have been able to find is that of Kazanjian in 1939. In his five cases he gives a very accurate description of the associated deformities of a congenital nature as well as those that are the result of the absence of the ramus. Since this thesis deals with the treatment only and since the defects that may accompany the condition are common knowledge, I will say that any of the first or second branchial arch or cleft maldevelopment or rearrangement may be found.

In order to avoid any duplication of the findings in these cases I refer you to Dr. Kazanjian's article[1] in which he gives a detailed description of the dental findings as well as the orthodontic diagnoses. He describes the five cases thoroughly: (1) One child six years old; no attempt had been made to repair mandible. (2) Ten years old; orthodontia treatment; an attempt to expand the upper arch and to advance the mandible by appliances; has not been seen since. (3) Eight years old; no attempt to correct the mandibular deformity. (4) Three years old; has not been seen since. (5) Was first seen at age of seven; had mechanical methods of treatment but were not effective in controlling lower jaw; in 1934 connected and transplanted bone to temporal bone above and mandible below.

Of these five cases only one was treated and an attempt made to reconstruct the mandible. This child, like many others, had other congenital deformities and some of these were in the process of reconstruction. At about the age of eight and a half or nine the mandible was reconstructed by means of a bone graft taken from the tibia and placed in a pocket in the cheek created by making a tunnel between an upper incision 1 inch in length in the temporal region and a second incision 1¼ inches below the border of the mandible. A graft was passed through the entire length of the incision and fitted into the temporal bone above and the mandibular bone below. X-ray showed no absorption of the transplant and there was bony union at each end. At a later date the transplant was converted into a joint at the level of fusion with the temporal bone.

At this time I wish to bring your attention to the fact that this procedure and a variety of mechanical appliances for the control of the mandible in cases of excision of the various segments of the mandible were the only methods under consideration for the treatment of this condition. As Dr. Kazanjian states: "The only function expected of these mechanical appliances is to transfer the function of the temporomandibular joint to some part of the body of the ramus that is present. Obviously, in children, this type of procedure could not be carried out because there would be a lag as the mandible developed."

The procedure of bone transplantation presents many difficulties but it has been done, the main objective being to improve the contour of that side of the face. Since all the authors who have written on the subject

recognized the fact that this bone transplant would not keep pace with the growth of the child, it would not be long before there would again be a disproportion between the two sides.

In his discussion Dr. Kazanjian brings out all of these facts very clearly, and in spite of the fact that he obtained an excellent result in this one case, he had the vision and foresight to note that in young children with congenital absence of the ramus a bone transplant was not the solution to the problem. In his summary he states the following: "The treatment of the mandibular defect is best postponed until the permanent teeth have erupted to permit the use of the proper splinting and other considerations outlined in the case."

The associated soft tissue defects in all cases were treated at an early age and not delayed.

In or about the year 1943 I saw a case of unilateral macrostomia. I had treated several patients up to that time by the technic which was available, but was much dissatisfied with the end results because of the usual scar contracture in the angle of the mouth. When this case of macrostomia presented itself, I sought every possible way to find the solution which would overcome this complication. I devised a flap technic which was published in 1945.[2] In the same case a congenital absence of the ramus of the left mandible was noted. I reviewed the literature at that time and, from what I found, determined that the best procedure would be to leave the condition until after the child had a full grown mandible and then do a bone graft as outlined by Kazanjian.

A few years later a boy about two years of age was brought to me with all the evidence associated with congenital absence of the ramus on the left side. He had a few ear remnants just anterior to the tragus, and the usual asymmetry and marked atrophy on the affected side. It was my intention to remove the extraneous remnants and to fill in the soft tissue defect through the same incision in order to improve the cosmetic appearance. Since there was an absence of the ramus, I decided to use cartilage, choosing stock cartilage which was available. In order to excise completely the remnants of skin and cartilage from in front of the ear, a transverse incision served the best purpose. A tunnel was made without difficulty in the direction of the temporal fossa and toward the body of the mandible. Much to my surprise there was practically no bleeding. The tunnel seemed to take form without effort. I closed the incision without drainage.

I again reviewed the literature but the situation was unaltered. After deliberating for some time it occurred to me that since nothing was being done for this type of case until after the twelfth year or longer, the tissues would continue to stay undeveloped. After that time, how much separation could one produce in order to overcome the tissue contraction on the affected side in order to insert a bone graft of suitable length? It then occurred to me that by interval grafting, say every two years, of a homologous cartilage or bone there would be a possibility of gradual increase in the space between the temporal fossa and body of the mandible over a period of time, which would prevent too great a shortening of the affected side and prevent too much displacement of the mandible; and when the mandible had fully developed, one would have a tunnel of sufficent size to insert an autogenous bone graft, during which time the soft tissues would already show a cosmetic improvement. With this point in mind I again repeated the procedure using cartilage. This avoided further surgery on the child.

At a time when considerable research was being done on heterogenous bone grafts, and being in a position to obtain fresh rib bone, the third time I performed surgery I used one of the ribs from a child operated upon the same day by another surgeon for a different congenital defect.

Mindful of the previous patient with the congenital absence of the ramus, this child was called in for treatment regularly. The same procedure was carried out on the second case, again using one of the ribs obtained in the same manner. It is my purpose to continue to increase the size of the graft every two years until after the mandible has attained full growth and then to replace it by an autogenous bone graft, followed by arthroplasty.

These cases are presented for the readers' criticism. Many questions enter my mind as they undoubtedly will yours, such as: (1) Will the many procedures produce any fixed pathologic condition that will overcome the good effects of the purpose intended? (2) Is the cost worth the end results? (3) Will the final result be any better than the practice of permitting arrested growth and then making the best of the situation? (4) Will the gradual

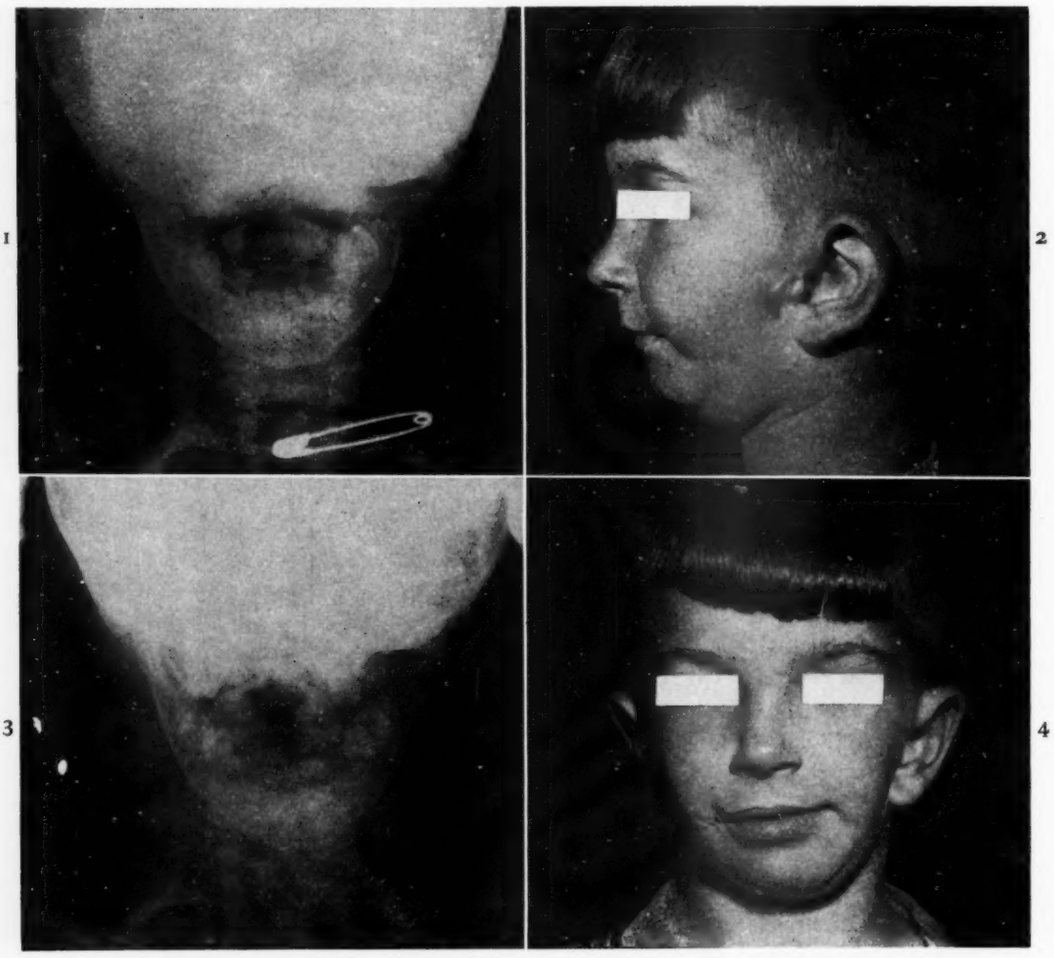

FIG. 1. X-ray, anteroposterior view, before surgery showing absence of the ramus.

FIG. 2. Lateral view following the first surgery, after insertion of cartilage.

FIG. 3. X-ray, anteroposterior view, following insertion of cartilage at the first operation.

FIG. 4. Front view following first cartilage implant.

process of lengthening the affected side serve to get better occlusion than by waiting for twelve years? (5) Will the psychologic effect of the deformity match the interval improvement in the soft tissues?

If bone is available, is it better to use bone grafts rather than cartilage grafts, and would there be less absorption than with cartilage grafts? A bone graft used in one of these cases had drill holes inserted to see if this would be more advantageous.

After having carefully analyzed the various advantages and disadvantages, I am of the opinion that the foregoing outlined form of gradual increase in the size and distance of the tunnel from the temporal fossa to the end of the body of the mandible will, over a period of years, (1) give a better opportunity to insert a full-sized bone graft; (2) improve the occlusion after the bone graft because the tissues will conform more to normal; (3) the soft tissues will appear normal for the transition period of growth because of the increase in material; (4) the type of material to be used should definitely be a homologous graft until the final ones which should be an autogenous bone graft; the homologous graft may be either cartilage or bone.

The following cases represent the procedures used:

CASE REPORTS

CASE 1. The patient, aged two, was first seen in February, 1947. The symptoms were

FIG. 5. X-ray before the second operation, showing some cartilage absorption.

FIG. 6. Lateral view showing closed incision following bone implant.

FIG. 7. Front view following bone implant. Note improvement in symmetry.

FIG. 8. Shows the x-ray, lateral view. Some cartilage has been removed. The bone implant is misdirected in spite of the external improvement. (This film was reversed when print was made.)

abnormality of the left jaw and caries of the teeth for the past two months. At this time x-rays showed a congenital absence of the ramus of the left mandible. (Fig. 1.) Oral surgery was advised when the boy reached the age of six.

Past history was as follows: He was a normal, full term infant delivered spontaneously, weighing 6 pounds, 4 ounces. The neonatal period was normal as was development. An operation was performed shortly after birth for the removal of a supernumerary right thumb and ear tags in front of the left ear. The corner of the mouth was also sewed. Family history was non-contributory. The various systems were essentially normal.

Physical examination was essentially negative except for a scarred area in front of the left ear with the left canal distorted so that the drum could not be seen. The teeth were very poor, with many absent teeth and caries. The lower jaw was deformed and sagged on the left side with an absence of the ramus of the left mandible. Surgery was canceled at this time because the patient was suffering from a cold.

The next admittance was on May 6, 1950. At this time the boy was in good condition for surgery.

A cartilage transplant was inserted through a vertical incision just anterior to the left ear. A canal was tunneled leading from the region of the angle of the mandible to the mandibular

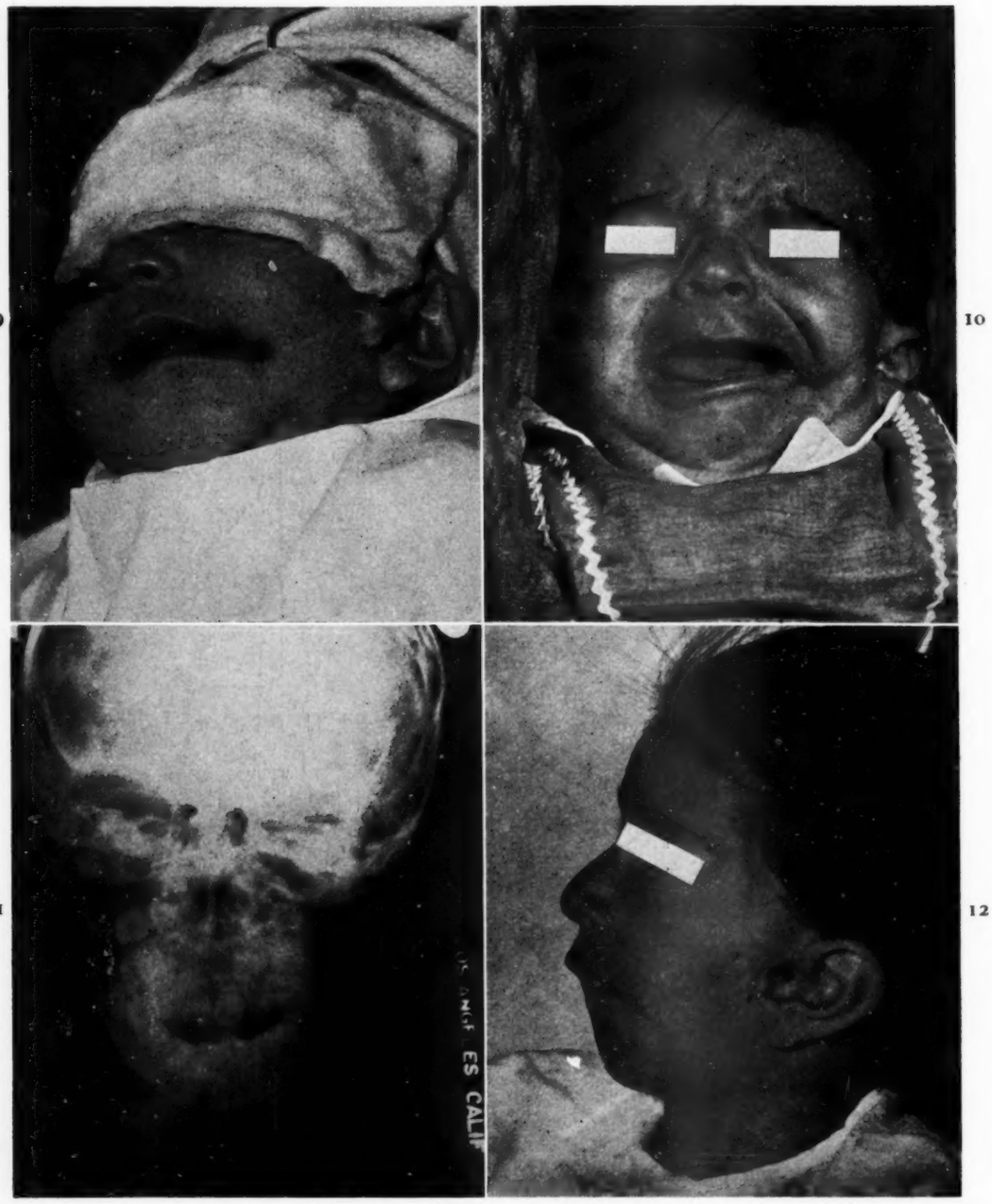

FIG. 9. Front view showing unilateral macrostoma, mouth closed, ear tag and the displacement of the jaw.

FIG. 10. Same child with the mouth open to show the direction of deviation of the mandible. The ear tag was removed. The macrostoma corrected by the author's technic.

FIG. 11. X-ray, anteroposterior view, to show position of bone implant.

FIG. 12. Lateral view of face showing the area of incision and appearance after the first operation.

fossa. (Fig. 2.) The external wound was closed. Stitches were removed on the seventh postoperative day and the patient was discharged. The postoperative course was uneventful. (Figs. 3 and 4.)

Fifteen months later the boy was readmitted. At this time evidence of the first implantation was noted. There was considerable improvement in the contour of the affected side although the mouth still deviated to the left. X-ray showed the cartilage in its original position. (Fig. 5.) On August 6, 1951, surgery

was repeated and some of the cartilage was removed. A bone rib was freshly removed from another child and directly inserted into this canal. The rib measured about 5 cm. in length and was placed again in the region of the angle of the mandible and extending toward the mandibular fossa. Closure was effected with No. 5-0 nylon. (Fig. 6.)

The postoperative course was uneventful. X-ray of the implant showed it to be in proper position. (Fig. 7.) To date there is a marked improvement. The boy will be allowed to wait until he is about twelve years of age. At that time an autogenous bone transplant will be inserted to form a permanent ramus. (Fig. 8.)

CASE 11. This case was first brought to my attention in 1943. At this time the patient, a female, had a unilateral macrostomia, bilateral pterygia and some ear tags on the left side. (Fig. 9.)

The macrostomia was corrected in 1943 by the Harris technic. The ear tags were removed at a subsequent operation in 1945. She was discharged and advised to return when six years of age. (Fig. 10.)

In 1952 the patient entered the hospital for correction of congenital absence of the left ramus of the mandible. Examination revealed a well developed, well nourished nine year old female in no distress. She made very little effort to talk and seemed to be mentally retarded. The face was asymmetric, with a scar from the left corner of the mouth to about 1 cm. from the left tragus. She had bilateral pterygia. The remainder of the physical examination was negative. Blood and urine examinations were both negative.

The left side of the face showed a flatness. Palpation showed absence of the ramus on that side. On opening the mouth the mandible deviated and there was considerable malocclusion. X-ray showed absence of the ramus of the mandible on the left side.

Surgery was performed on March 24, 1952. A heterogenous rib bone from a young child was inserted through a vertical incision just anterior to the tragus. By blunt dissection a canal was made extending from the free end of the mandible to the temporal bone. The bone measured about 3 cm. in length and 1 cm. in diameter. Closure was done with No. 4-0 nylon. The postoperative course was uneventful. (Figs. 11 and 12.)

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SUBMANDIBULAR-NOTCH SLIDING OSTEOTOMY FOR SURGICAL CORRECTION OF MANDIBULAR RETRUSION, A NEW TECHNIC

PRELIMINARY REPORT

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THE object of this article is to present a preliminary report of a new surgical procedure in reconstructing the retruded mandible.

There are pronounced cases of mandibular retrusion which are beyond the scope of orthodontic treatment. Patients with a lesser degree of deformity may not seek treatment until they are beyond the orthodontic age. Orthodontic treatment may establish good occlusion but fail to obtain a satisfactory facial form in some cases as the mandibular body and rami cannot be changed. The only treatment available to these patients is maxillofacial surgery. The surgeon must rely upon the orthodontist to define those cases in which surgical reconstruction is indicated. "The surgeon hews out the rough structure and leaves the finishing touches to be worked out later by the dentist."[1]

The term "retrusion" is derived from the Latin, "*re*—backward + *trudere*—to thrust."[32] Other terms used in the literature for this condition are: developmental retrognathia, agnathic mandible,[26] microgenia,[20–21] retrusive mandible,[7] recession of the mandible,[9,10] receding lower jar,[2] micrognathia,[22–24] underdeveloped lower jaw,[6] retraction of mandible, orthognathism,[34] mandibular deficiency[4] and hypoplasia of mandible.[37]

The etiology in a particular case of mandibular retrusion is usually in doubt. In general there are three causes: (1) Underdeveloped mandible: Sicher[29] has shown that the main growth center is the hyaline cartilage in the condyle. Interference (congenital, infectious or traumatic) with this center before growth is complete results in retrusion. Ankylosis may or may not be associated with retrusion but some degree of retrusion is present in all cases of ankylosis occurring before complete growth of the mandible. (2) Bone loss: infectious or traumatic. (3) Fractures healed in retrusion.

The cases are further classified as to bilateral or unilateral. The predominance of unilateral (or asymmetric) cases is explained by the mathematical improbability of a cause occurring bilaterally. Dingman[12] states that the retrusion cases studied at the University of Michigan were due to general underdevelopment of the mandible, with a variable gonial angle. The factor of enlarged tonsils, adenoids and nasal obstruction as a cause of mouth breathing and faulty development of the jaw has been questioned. Babcock[1] thought that nasal obstruction may be caused by the malformed jaws.

Although these patients are dental cripples, they usually seek help because of their appearance. The psychic disturbances associated with retrusion of the mandible should not be underestimated. Often the patient will voluntarily state how the deformity has marred his happiness and interfered with normal employment and social success. Rarely is careful questioning necessary to bring out these basic inner conflicts. The functional disabilities are obvious, such as interference with proper mastication and speech. A thorough examination should be made, using every aid that is available, including roentgenograms with cephalometric measurements, laboratory tests, photography, face masks and carefully articulated models of the dental arches. The surgical articulator described by Waldron[34] would probably be of value in the predetermination of the best type of operation for a particular case.

MAXILLOFACIAL SURGICAL TREATMENT AS CURRENTLY DESCRIBED

A large number of surgical technics are found in the literature. The very number shows that no single operation is indicated in all cases. The surgeon that restricts himself to a

single method is somewhat akin to an anesthetist who would use only one anesthetic agent for every case. It is the conviction of the authors that maxillofacial surgery should not be included in the treatment plan of a patient where an acceptable result can be obtained with orthodontics, prosthetics or alveolar surgery combined with a cartilage graft to the chin.[14]

Most of the reported maxillofacial surgical procedures for the correction of mandibular retrusion can be classified as follows: (1) Sliding osteotomy: Z-step cut in body;[8,12,13,24,31,32,35] L-step cut in body;[18,19,34] L-step cut at gonial angle;[35] curved cut at gonial angle;[8,24] horizontal cut of ramus below foramen;[8,10,24] horizontal cut of ramus above foramen;[1,6,12,18,32] vertical cut condylotomy;[20,21] horizontal cut condylotomy;[1] the technic which is the subject of this article. (2) Osteotomy with bone graft: ramus;[15] body.[9,24] (3) Flail joint.[1,33] (4) Condylectomy.[32] (5) Condylar displacement.[2] These can further be subdivided as to the open or closed approach and also whether intraoral, extraoral or a combination.

SUBMANDIBULAR-NOTCH SLIDING OSTEOTOMY

Success will depend on an accurate preoperative determination of the angle and extent of the osteotomy. All possible means of study should be used. Roentgen examination should include cephalometric measurements. Photographs and a face mask should be made. Accurate plaster models of the dental arches are mounted on an articulator with a movable mandibular unit. The maxillary model is mounted in relation to the hinge axis and the eye-ear plane by means of a face bow. The preoperative centric mandibular position is determined with an intraoral gothic arch tracing. The postoperative centric mandibular relation to the maxilla is an arbitrary position. This postoperative position is the one which will establish the best intermaxillary relation and occlusion. If orthodontic treatment is planned, part or all may be advisable before surgery. In other cases the best intermaxillary relation may be found to have an unstable occlusion. This can be corrected roughly by selective spot grinding of the patient's teeth, or a small acrylic splint may be constructed to place between the arches. A metal pattern is constructed in reference to the eye-ear plane to indicate the amount and direction of the osteotomy to be performed. A day or two before surgery wire loops or arch bars are placed on the maxillary and mandibular teeth to facilitate intermaxillary wiring during the operation.

The anesthetic of choice is local anesthesia using infiltration of the skin flap and deep block of the third division of the fifth nerve. Previous to infiltrating the tissues the incision is outlined with a skin pencil or stain. Start ½ cm. above the shaved hairline and 5 cm. above and anterior to the ear. Mark directly to the most anterior portion of the helix and then down along the anterior inner margin of the ear. End the incision ½ cm. behind the lobule. The outlined skin flap is elevated by sharp dissection to expose the region of the mandibular notch adequately. This flap is brought forward and immobilized to the cheek with two or three sutures. Bleeders are controlled by either ligation or electric coagulation. The point over the mandibular notch is determined by deep palpation while the patient is instructed to move the jaw. The tissues directly over the mandibular notch are divided by blunt dissection down to and through the periosteum covering the ascending ramus. That partion of the ascending ramus in the region of the mandibular notch between the coronoid process and the neck of the condyle is exposed. Extreme caution is taken to prevent injury to the facial nerve. An opening between 1½ to 2 cm. is adequate. With small blunt retractors this opening can be alternately moved directly over the desired area of bone. Division of the bone is made with a bur under a constant stream of normal saline solution. The first cut made (Figs. 1 and 2) is the anterior vertical cut (Fig. 2*a*) starting as far forward on the coronoid process as is necessary for the case at hand. Carry the cut vertically downward, parallel with the anterior border of the ramus. Care should be taken both in designing and making this cut so that it will not extend so far down on the ramus that the horizontal cut will sever the inferior alveolar nerve and vessels but also not be too high that the horizontal cut will not leave sufficient bone for strength in the lowest portion of the sigmoid notch. The horizontal cut (Fig. 2*c*) is then started for a distance of approximately ½ cm., in accordance with the direction of the predetermined pattern. At this point a small drill hole is made through the antero-inferior angle

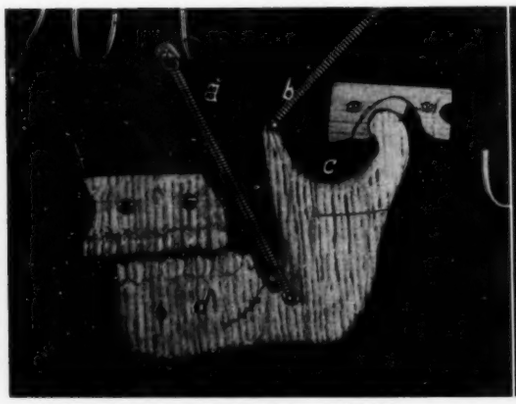

FIG. 1. Model of retruded mandible, preoperative. (*a*) Spring, representing combined action of masseter and internal pterygoid muscles in plane of temporalis muscle (*b*); (*c*) mandibular notch; (*d*) retruded mandible.

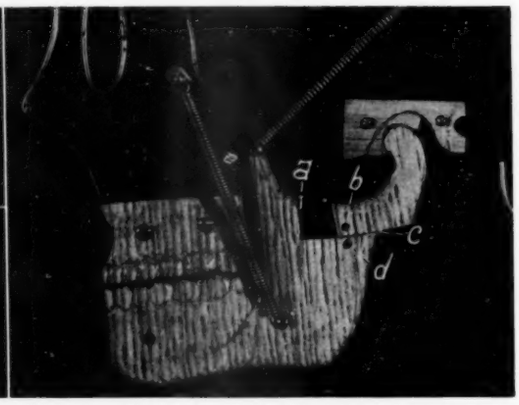

FIG. 2. Model of retruded mandible surgically corrected by the submandibular-notch sliding osteotomy. (*a*) Vertical cut; (*b*) hole drilled in proximal fragment; (*c*) horizontal cut; (*d*) hole drilled in distal fragment.

of the proximal fragment. (Fig. 2*b*.) The horizontal cut is then continued posteriorly to effect a condylotomy. The wound is temporarily packed. The same procedure is carried out on the opposite side in accordance with the predetermined pattern for that side. After both sides have received the submandibular-notch sliding osteotomy, an assistant will place the mandible in the predetermined improved forward position (Fig. 2) and fix with intermaxillary wires. A small hole (Fig. 2*c*) can now be drilled directly below the previously placed hole in the antero-inferior corner of the proximal fragment. A 22 gauge, stainless steel wire is used for interosseous wiring between these two holes. (Figs. 11, 13.) The wound is closed by placing several mattress type absorbable sutures to close the bluntly dissected deeper tissues. The skin flap is returned to its original position and immobilized with interrupted silk sutures. The first osteotomy is re-exposed. A drill hole is made in the distal fragment, an interosseous wire placed and the wound closed as described. A small rubber drain is placed just under the skin below the lobule and a head bandage applied. The drain is removed in twenty-four hours, the skin sutures in four days and the intermaxillary wires in six weeks.

CASE REPORT

N. R., a twenty-two year old white male, was referred to us August 3, 1950, for the surgical correction of his maxillofacial deformity. The patient had a receding chin since birth. He was told that his birth was difficult. No other trauma of the jaw was known. The patient had received eight years of orthodontic treatment. During this treatment the maxillary cuspids and mandibular second bicuspids were extracted. He was retiring and reluctantly gave only meager information. His mother and father stated that the boy had completed two years of college, was near the top of his class in all studies but had made a poor social adjustment. He associated with only a very few male companions. During summer vacations he isolated himself as a fire-watcher with the Forestry Service. His few friends had recently been called to Army duty and the patient expected his call soon. The parents were fearful of psychic trauma to the patient if forced into army society without improvement of his facial appearance.

The patient gave a past history of spontaneous epistaxis at the ages of nineteen and twenty-one years, a somewhat involved story about various metabolic levels, taking thyroid, and not taking thyroid. He had a tonsilectomy at age six, but otherwise had always been well. Physical examination revealed a thin young man with a receding lower jaw. (Figs. 3 and 4.) The mandible was in left lateral deviation (Fig. 5) and underdeveloped. A normal sized upper lip could not cover the crowns of the maxillary anterior teeth. There was overdevelopment of the maxillary alveolar process with a constricted arch and deep palatal vault. The maxillary cuspids and mandibular second bicuspids were missing. The right mandibular

FIG. 3. Preoperative photograph, full face, showing left unilateral mandibular retrusion, overdeveiopment of maxillary alveolar process and extrusion of the maxillary teeth.

FIG. 4. Preoperative photograph, left profile, showing left unilateral mandibular retrusion, overdevelopment of maxillary alveolar process, extrusion of the maxillary teeth and underdevelopment of the body of the mandible.

FIG. 5. Preoperative photograph showing occlusal abnormality caused by left unilateral retruded mandible.

third molar was unerupted. The posterior teeth were restored with faulty silver fillings. A short high-pitched systolic murmur was heard at the left of the sternum in the fourth intercostal space. This was not transmitted. No diastolic murmur was heard and the rhythm was regular. There was no cardiac enlargement. The rest of the physical examination was negative. Hemogram and urinalysis were normal. Basal metabolism rate was minus 26 and the fasting blood cholesterol 170 mg. per cent. Electrocardiogram showed right axis deviation but was otherwise normal.

Diagnosis was as follows: (1) mandibular retrusion, left, unilateral; (2) underdevelopment of the mandible; (3) overdevelopment of the maxillary alveolar arch with extrusion of the maxillary anterior teeth; (4) rheumatic

FIG. 6. Preoperative cephalometric roentgenogram from which a Down's analysis was made. Surgical repositioning of the mandible was indicated to reduce the convexity of the face.

of the face.[17] The patient was also examined by the Dr. Cecil Collins Study Group at the University of Southern California, School of Dentistry. They concurred that the elongated maxillary alveolar process with extrusion of the teeth could be corrected only by complete dental extractions, alveolomerotomy and a full maxillary denture.

With the aid of roentgenograms, face mask, photographs and accurately articulated models of the dental arches (Figs. 7 to 9) the patterns for the osteotomies were made. To obtain the best intermaxillary relation it was found that a simple condylotomy was necessary on the right (Fig. 10) to prevent rotation of the condyle. The study showed that on the left the condylotomy (Fig. 11) must allow for an anterior slide of 1 cm. and be 25 degrees from the eye-ear plane. This would result in a vertical lengthening of the ramus of about 4 mm.

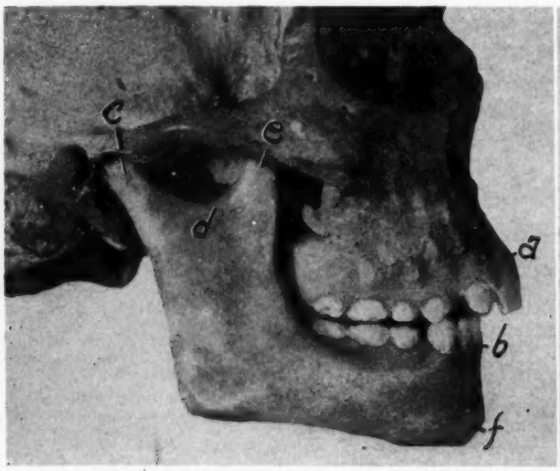

FIG. 7. Photograph of model, right side. (*a*) Model of patient's maxillary teeth attached to skull; (*b*) model of patient's teeth on artificial stone mandible; (*c*) condyle; (*d*) submandibular-notch area; (*e*) coronoid process; (*f*) underdeveloped body of the mandible.

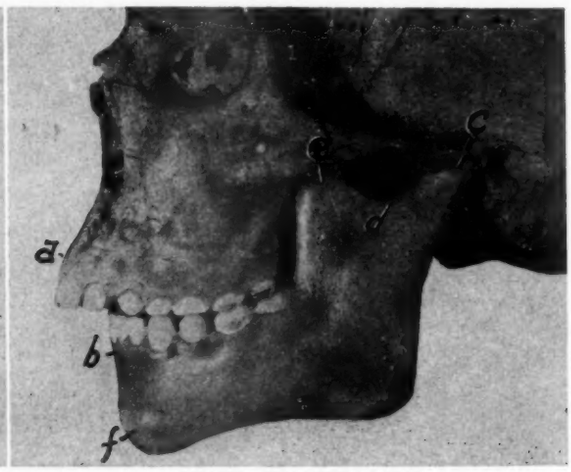

FIG. 8. Photograph of model, left side. (*a*) Model of patient's maxillary teeth attached to skull; (*b*) model of patient's teeth on artificial stone mandible; (*c*) condyle; (*d*) submandibular-notch area; (*e*) coronoid process; (*f*) underdeveloped body of the mandible.

heart disease with mitral insufficiency, compensated; (5) hypothyroidism, mild.

A cephalometric study (Fig. 6) was made which indicated[28] that further orthodontic treatment was contraindicated. A Down's analysis revealed the poor skeletal and denture pattern which was further complicated by the extraction of two mandibular bicuspid teeth in a face which presented a severe orthognathic condition. Surgical repositioning of the mandible was indicated to reduce the convexity

On August 28, 1950, at St. Vincent's Hospital, Los Angeles, the patient's left mandibular retrusion was surgically corrected. A right L-step condylotomy (Fig. 12) was done, using a 2 mm. bur. This prevented rotation of the right condyle. The left side was then corrected by a submandibular-notch sliding L-step osteotomy (Figs. 13, 14) as previously determined and described.

After six weeks the intermaxillary wires were removed. Jaw motion was sufficient after ten

days for new impressions to be made of the dental arches. Models were mounted on an anatomic articulator utilizing an intraoral gothic arch tracing and a face bow. The thirteen plaster maxillary teeth were removed and the process carved to allow a 7 mm. closure of the bite. The new hinge axis allowed the mandible to come forward approximately 4 mm. A temporary immediate maxillary denture-like splint was prepared on this model.[11]

On November 8, 1950, the patient was hospitalized. Under nasal tracheal pentothal-nitrous oxide-oxygen anesthesia the over-developed maxillary alveolar process with extrusion of the maxillary anterior teeth was surgically corrected. The remaining maxillary teeth were extracted, alveolomerotomy performed and the temporary full maxillary denture-like splint was inserted.

On January 10, 1951, at St. Vincent's Hospital, a large cartilage implant to the mandible was done. Under local anesthesia a 5 cm. curved incision was made beneath the chin. The lower and anterior surfaces of the under-developed symphysis were exposed. The mental vessels and nerves were ligated and severed. The periosteum on the anterior surface of the mandible, from a point 1 cm. posterior to both mental foramen was elevated. Three sections of heterogenous cartilage were sculptured. The first section of cartilage, about 7 cm. long, was incised in three places and then hinged together with No. 000 chromic catgut. Hinging permitted close adaptation of the cartilage to the bone surface. The second section, about 5 cm., in length, was carved to fit over the upper surface of the first cartilage. The two sections were fastened together with several catgut sutures. Section number three, about 2½ cm., was trimmed to fit on top and fixed to the other two sections. After the three finished sections were fastened together, the entire cartilaginous mass was fitted over the anterior surface of the mandible. It was immobilized with No. 000 chromic catgut to the periosteum and soft tissues directly beneath the symphysis, through the cartilage, back through the soft tissues and tied. This was done several times to immobilize the cartilage to the bone. The upper skin flap was brought over the cartilage and approximated to the lower flap by means of a No. 32 stainless steel subcuticular suture. The epithelial edges were approximated with

FIG. 9. Photograph of model, anterior view. Centric relation established by the University of Southern California, School of Dentistry. (*a*) Model of patient's teeth attached to skull; (*b*) model of patient's teeth on artificial stone mandible. Model shows deformity caused by left unilateral retruded mandible and over-development of maxillary alveolar process.

interrupted No. 000 silk sutures. A modeling compound mold was fitted over the graft to immobilize the cartilage implant further. A large collar bandage was employed and stabilized with adhesive tape.

The patient made an uneventful recovery. (Figs. 15 to 17.) A second denture was constructed[11] and he entered the Army. Upon his return from Korea in November, 1952, he was examined. There had been no change in the immediate postoperative results except that his denture needed relining.

Comment: This is not an unusual case. The only original contribution is the submandibular-notch sliding L-step osteotomy to advance the left mandible. Possibly the right side did not need surgical intervention, but we believed it better not to rotate this condyle in a horizontal plane, thus preventing future joint disturbance. An L-step or Z-step sliding osteotomy in the body of the mandible was considered but not done as it would have necessitated the loss of some mandibular teeth and the construction of a partial mandibular denture. Also, a sliding osteotomy in the body may disturb the nerves, blood vessels and glands in the floor of the mouth. An osteotomy completely transecting the ramus is unphysiologic. Whether this cut is straight or curved, above or below the foramen or at the gonial angle is not the problem. The muscles of mastication

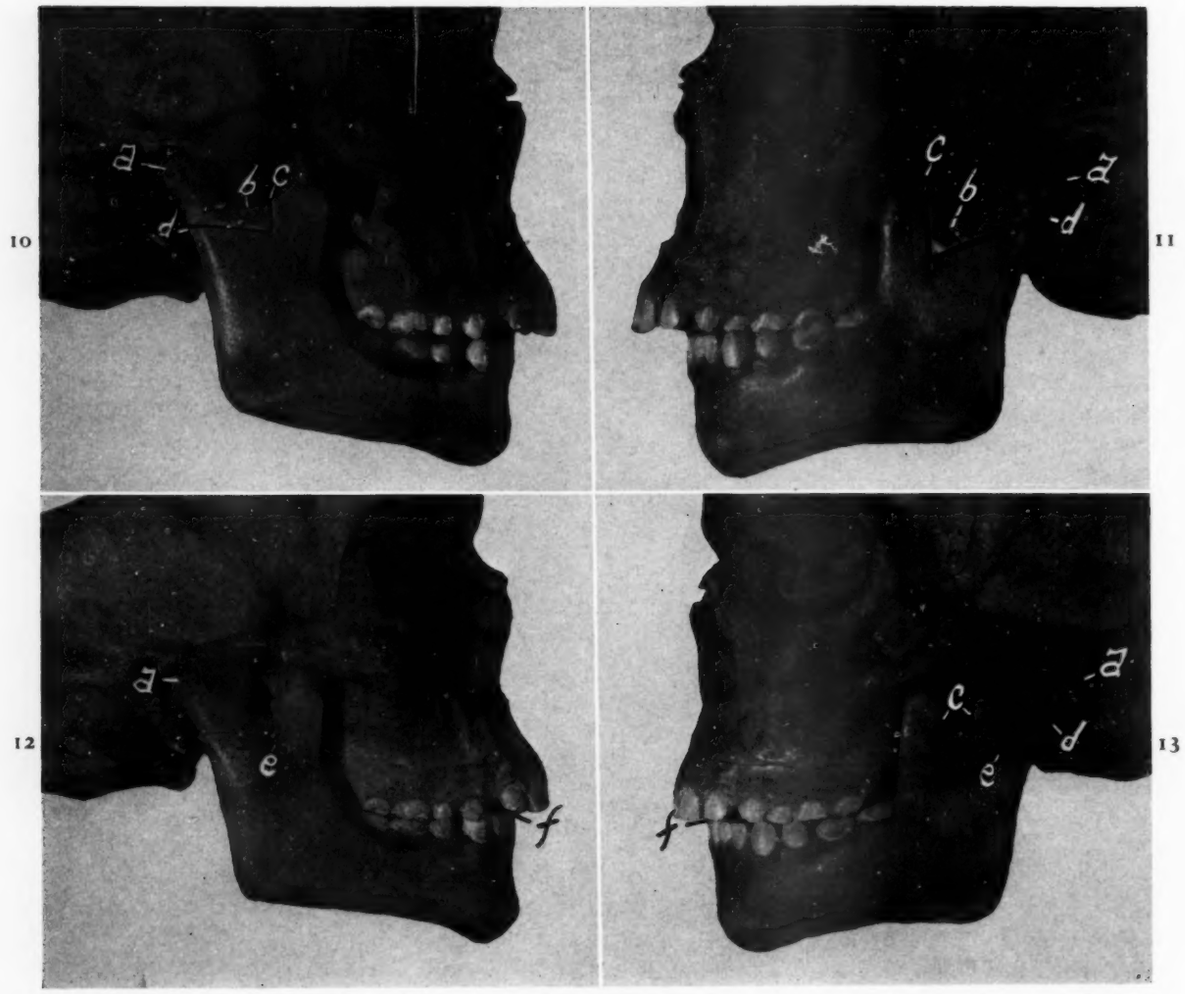

FIG. 10. Photograph of model, right side, showing osteotomy to prevent rotation of right condyle. (*a*) Condyle; (*b*) drill hole in proximal fragment; (*c*) vertical cut; (*d*) horizontal cut.

FIG. 11. Photograph of model, left side, showing cut for submandibular-notch sliding osteotomy. (*a*) Condyle; (*b*) drill hole in proximal fragment; (*c*) vertical cut; (*d*) horizontal cut.

FIG. 12. Photograph of model, right side, postoperative. (*a*) Condyle (not rotated by surgery on opposite side); (*e*) interosseous wire; (*f*) corrected occlusion.

FIG. 13. Photograph of model, left side, postoperative. (*a*) Condyle (in normal position); (*c*) vertical cut; (*d*) horizontal cut; (*e*) interosseous wire; (*f*) corrected occlusion.

must have a tooth contact to transmit their resultant force to the maxilla.[27] If this condition is not satisfied, the muscle action tends to disrupt the site of osteotomy. In our experience the grave complications of an open bite or a non-union are so great as to contraindicate these procedures. A vertical condylotomy is useful only in those cases in which an open bite is to be corrected. A horizontal condylotomy allows too little anterior correction to be justified. Creating flail joints, condylar displacements or doing condylectomies for these deformities are unphysiologic and contraindicated.

Advancement of the mandible by this new technic is necessarily limited in amount by the width of the ramus in the submandibular-notch area. It would be a rare case which would pass this limit.

The patient exhibited an inverted gothic arch tracing. His convenience bite was anterior and to the right of his condylar centric relation. By this conscious or unconscious effort the muscles of mastication had been conditioned

to the intermaxillary relation established by maxillofacial surgery. The postoperative mandibular position was in harmony with the patient's muscular action balance. It may be this fact that permitted the successful outcome of the surgery. The only defense for the total maxillary dental extractions and alveolomerotomy was that the cuspids were missing, the deformity severe, the remaining teeth in poor repair and the advice of several prominent dentists.

Previous to the cartilage implant the patient pleaded to make the chin as big as possible. As advocates of local anesthesia in maxillofacial surgery we were interested that after the patient had experienced both local and general anesthesia in the first two operations, a local anesthetic was his choice for the third.

FIG. 14. Photograph of model, anterior view, postoperative, showing correction of left retruded mandible by submandibular-notch sliding osteotomy.

FIG. 15. Photograph of patient seven weeks after final surgery, left lateral view, showing correction of left retruded mandible, overdevelopment of maxillary alveolar process, extrusion of maxillary teeth and underdevelopment of the mandible.

FIG. 16. Photograph of patient, front view, postoperative, showing reconstructive surgery completed.

Although the improvement in the patient's appearance was striking, his improvement in personality was even more. The patient became friendlier and somewhat loquacious, with a moderate aggressiveness. This personality improvement proved to be correct when he was seen two years later after a tour of duty with the Army in Korea. His reaction to his Army

FIG. 17. Photograph of patient, postoperative, front view, showing surgical correction of left unilateral retruded mandible, overdevelopment of maxillary alveolar process, extrusion of the maxillary teeth and underdevelopment of the mandible.

duty was entirely normal and he is now working in an aircraft factory temporarily before resuming his college course.

SUMMARY AND CONCLUSIONS

A new surgical procedure is presented for the correction of the retruded mandible. This technic is an L-step submandibular-notch sliding osteotomy. Former efforts are reviewed, with a bibliography. This procedure may be used in cases of retrusion with ankylosis. The sliding submandibular-notch osteotomy could be done first and then the ankylosis corrected.[30]

Plastic reconstruction of the underdeveloped mental process combined with minor oral surgery can best care for most of the retrusive deformities.

No conclusions can be drawn from a preliminary report. Obviously, years of observation of the patient will be necessary for the total evaluation of the procedure. This patient will be examined from time to time, the functional results studied, evaluated and recorded for publication later.

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Several words were inadvertently omitted in the article entitled "Trichlorethylene Anesthesia in Pediatric Urology" by Herman I. Roseman, M.D., published in the April 1953 issue of the Journal. The sentence starting on line 20, page 540, should read as follows: "This tachypnea can be quickly overcome by a decrease in the concentration of trichlorethylene and by the administration of oxygen under moderate pressure."

ARTHROPATHIES OF THE TEMPOROMANDIBULAR JOINT

ROENTGENOLOGIC ASPECTS

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San Francisco, California

FUNCTIONALLY, the temporomandibular joint is one of the most important joints of the body. Although other joints may become fixed and useless, sustenance at least can be maintained as long as the temporomandibular joint can articulate. Yet it is the stepchild of arthrology.

There are several reasons for this. Perhaps the main reason is the location of this joint. It is recessed with overlying and surrounding bony structures of the skull and bulky soft tissues including muscle bundles, fat, connective tissue and the parotid gland. It is difficult to examine by ordinary means; it is difficult to visualize clearly by x-ray projection.

Another important reason for the unique ambiguity which enshrouds this joint is the fact that concerted interest has not generally been applied to it. Rheumatologists seem to include it as just another joint. The medical profession at large tends to relegate care of many sorts of involvement of it to the dental profession. The dental profession in turn seems to assume a degree of hesitancy when confronted with over-all responsibility to care for its disorders. These statements, of course, are made with due respect toward the astute observations recorded by various men in each of these professions. Now it is stimulating and consoling to realize that at least the specialty of maxillofacial surgery is devoting keen interest to this joint.

ANATOMIC PHYSIOLOGIC CONSIDERATIONS

Clinicians recognize the fact that the anatomy and physiology of the temporomandibular joint are perhaps the most unique of any joint in the human body. The peculiarities of construction, the character and range of function and the innervation of this joint account for many insidious and seemingly unrelated clinical manifestations so often misinterpreted.

The articulation is between the condyle of the mandible and the glenoid fossa of the temporal bone; admittedly, this is generally recognized. (Fig. 1.) However, the articulation is *not* as most consider it to be, concerned with the uppermost cortex of the condyle and the depth of concavity of the glenoid fossa. Instead, the condyle of the mandible being relatively anteverted, the articulation is essentially concerned with the anterosuperior surfaces of the condyle and the posteroinferior surfaces of the mandibular eminence and adjacent anterior half of the glenoid fossa. In fact, with wide open extension of the mouth, normally there is excursion of the condyle over and in some individuals even anterior to the mandibular eminence. Too often normal excursion, as visualized roentgenographically, is misinterpreted as dislocation.

The degree of excursion varies with the pathologic process. In most instances excursion is reduced when pathologic changes have occurred; the condyle may not glide even on to the mandibular eminence as the mouth is open; it may remain in fixed position, mouth closed or open. Occasionally overexcursion is caused by a disease process. This aspect of physiology dictates that an x-ray examination of the condyle-glenoid relations should be made by comparison of both the closed and the open mouth positions, both sides being studied.[4,12]

The anterosuperior surfaces on the condyle of the mandible and the posteroinferior surfaces of the mandibular eminence and adjacent anterior half of the glenoid fossa are lined by fibrocartilaginous cushionings.[23] These are the articular cartilages. It is rather interesting to note that whereas with most joints the articular cartilages are composed of hyaline cartilage, in the case of the temporomandibular joint hyaline cartilage is found only in the depth, the surfaces and peripheries of the articular cartilages being more fibrous in makeup. This anatomic characteristic likely accounts for

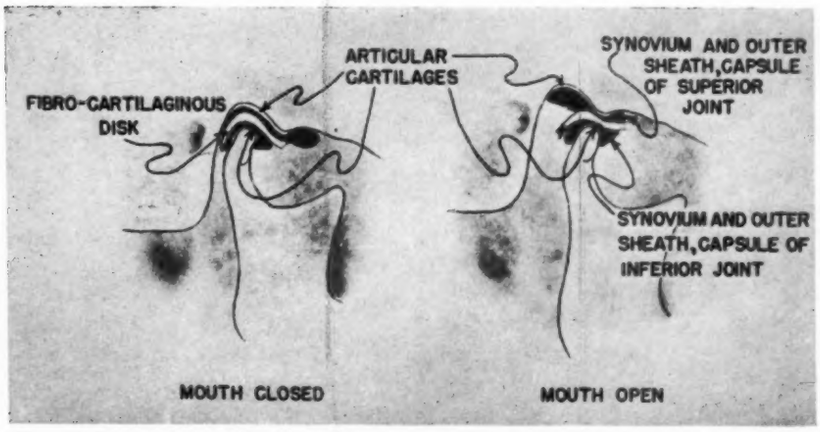

ARTICULAR CARTILAGES
FIBRO-CARTILAGINOUS DISK
SYNOVIUM AND OUTER SHEATH, CAPSULE OF SUPERIOR JOINT
SYNOVIUM AND OUTER SHEATH, CAPSULE OF INFERIOR JOINT
MOUTH CLOSED
MOUTH OPEN

FIG. 1. Temporomandibular joint, lateral projection. Incident ray angled 33 degrees toward feet.

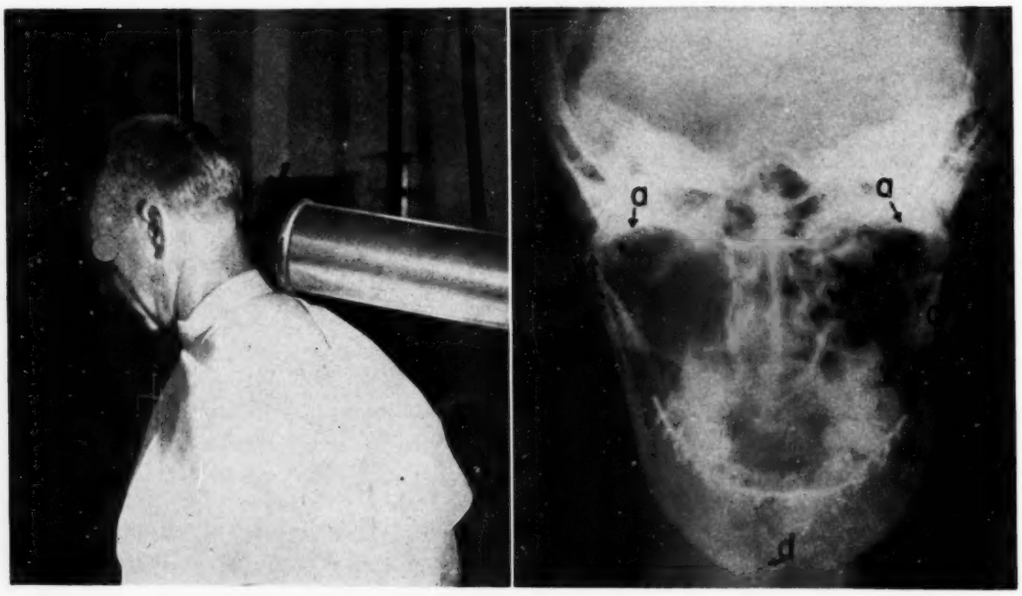
some of the increased sturdiness of this joint, fibrocartilage being more repairable than hyaline cartilage.

In addition to the cushioning provided by the articular cartilages the temporomandibular joint has contained an interposed disc of fibrocartilage, a meniscus similar to those found in the knee joint. However, unlike the knee joint, the meniscus in the temporomandibular joint in most instances is a *complete* partition, dividing the joint space into two compartments. Although we speak of a temporomandibular joint, actually we should think of a double tier, the upper compartment more accurately being defined as the "menisco temporal joint" and the lower compartment, the "meniscocondylar joint."[14] No doubt nature provided this arrangement in order to insure joint function more definitely regardless of pathologic changes which might extend either from the middle ear and temporal bone above or from the substance of the mandible below.

The meniscus is firmly fixed to the posterior rim of the condyle of the mandible, and with excursion of the latter it moves in close apposition to it. This relationship may prompt shortening of the posterior ligamentous attachment in certain cases of "popping jaw." The temporal joint is relatively large and loose while the mandibular joint is smaller and more tightly reinforced. The meniscus provides resilient support for tolerance of the extreme range of motion required of the composite temporomandibular joints. The condyle of the mandible is required to move not only over the mandibular eminence, a considerable distance of lengthwise travel, but there is also excursion of the condyle laterally. The temporomandibular joint is ginglymo-arthrodial; it is a hinge-sliding joint.

Each of the two joint compartments is lined internally by synovial membrane. Embryologically and in the case of infants, the synovial membranes extend as continuous linings, completely covering the meniscus superiorly and inferiorly and continuing as innerlinings of the respective walls of the two compartments, extending over the articular cartilages. With usage, those portions of the synovial membranes subjected to pressure by articulation are simply worn down to where they become fused with the respective cartilages.

The synovial membranes are supported peripherally by a thin, loose envelope of fibrous tissue, the capsular ligament. This is attached to the circumference of the mandibular fossa and the borders of the mandibular eminence. Inferiorly, it is attached to the inferior ridge of the condyle of mandible. Laterally, additional support is provided by the temporomandibular ligament which extends from the base of the zygomatic process of the temporal bone to the posterior border of the mandible. Medially, an additional support is provided by the sphenomandibular ligament which extends from the spina angularis of the sphenoid bone to the lingula of the mandibular foramen. The muscles of mastication serve as peripheral investment, the temporalis, the masseter and the internal pterygoid functioning mainly to clench the jaw, and the external pterygoid and platysma serving to open it. Laterally, there is the thick pad of the



2A 2B

FIG. 2. A, exaggerated nose-forehead positioning. Observe that the forehead is resting onto an upright Bucky; the apex of the nose is spaced from the Bucky to the extent of approximately 1.0 cm. Even in case of fracture or dislocation of the mandible, this is not an uncomfortable positioning. Otherwise, observe the alignment of the cone of the x-ray tube, this indicating the alignment of the so-called central ray to a point 6.0 to 8.0 cm. below the external occipital protuberance, the ray projected through the superior frontal plane. B, roentgenographic projection with positioning demonstrated in (A). Observe: (*a*) outlines of glenoid fossa; (*b*) lateral deviation of condyle of mandible; (*c*) fracture of neck of mandible. In this instance, these abnormalities were bilateral, as frequently found in the case of a blow sustained by the chin with resultant fracture (*d*).

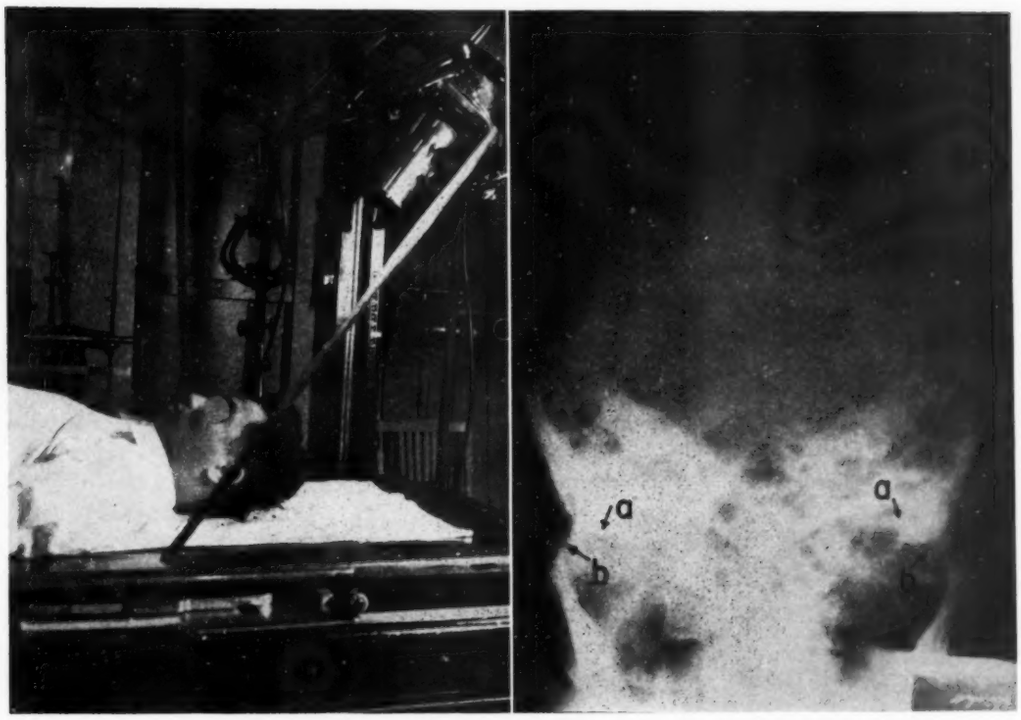
parotid gland. It is interesting to note that a small lobule of this gland extends into the posterior recess of the glenoid fossa just posterior to the condyle; hence the intimate interrelationship of these structures (intense pain upon mastication when the parotid is inflamed and swelling of the parotid when the joint is involved).

The joint is innervated by branches of the fifth cranial nerve, the masseteric supplying the anterior portion of the joint and the auriculotemporal supplying the posterior and medial aspects. Receptor stimuli provided to either of these nerves account for local pain. Overflow of nerve stimuli is a common occurrence with distribution of pain into the ear, the temporal region or even into the occiput. The chorda tympani emerges from the cranium in close opposition to this joint. Although a considerable difference of opinion has been expressed[2,9,23] as to just how this nerve may be affected by pathologic disease in the temporomandibular joint, it appears to be an established fact that such extraneous symptomatology as burning pains along the anterior two-thirds of the tongue, derangements of taste or pain in the pharynx must be accounted for on the basis of overflow of stimuli along the course of this nerve. Such stimuli may account for vascular dilatation and excessive secretions by the submaxillary and sublingual glands—further examples of seemingly unrelated manifestations in connection with temporomandibular joint pathology.

ROENTGENOGRAPHIC ASPECTS

The overlying structures of the skull and maxillofacial bones complicate x-ray visualization of the temporomandibular joint. One and another positioning may be required for a particular case:

With an exaggerated nose-forehead positioning ordinarily it is practical to have the film in an upright position (within the Bucky), and to have the patient sitting. (Fig. 2A.) The so-called central ray should be directed cephalad, aligned to a point 6 to 8 cm. below the external occipital protuberance and projected through the superior frontal plane. This angulation of the beam projects the occiput high, thereby



3A 3B

FIG. 3. A, exaggerated "frontal-occipital" projection. Observe that the head of the patient is resting on a ray-transparent block of balsa wood to provide for maximum flexion of the head and resting the chin upon the chest. Observe the angulation of the x-ray tube; the extension tape indicates the direction of the so-called central beam, extending through the plane of the upper forehead through the suboccipital region at a level about 8.0 cm. below the external occipital protuberance. B, roentgenographic projection accomplished with positioning shown in (A). Observe: (*a*) outlines of glenoid fossae; (*b*) laterally deviated condyles of mandible.

clearing the condyles of the mandible in relation to the respective glenoid fossae. (Fig. 2B.)

A similar end result might be accomplished with reversed positioning of the patient. Making use of the exaggerated "fronto-occipital" projection of the beam (Fig. 3A), a ray transparent support should be placed under the occiput of the patient and the patient instructed to flex the head to the utmost whereby the chin rests upon the chest. The so-called central ray is angled caudad extending through the upper forehead and to a level 6 to 8 cm. below the external occipital protuberance. This projection (Fig. 3B) should also visualize the condyles relatively clear of the confusing opacities in the base of the skull.

In our experience the most useful single roentgenographic procedure is that provided by Bullitt's mastoid stereoscopic changer. (Fig. 4A.) With this apparatus the head of the patient is held in a virtual vise whereby comparative stereoscopic studies can be accomplished on the two sides, perhaps comparative studies with the open mouth positioning versus the closed mouth positioning. When using this apparatus for study of the temporomandibular joint, the head is lowered about 3 cm. below the level ordinarily used when the studies are intended for the mastoid. The so-called central ray is projected to a point about 2 cm. anterior to the tragus of the ear. The resultant roentgenogram (Fig. 4B) may at first seem complicated, but with third dimensional viewing the relations can be clearly defined.

For anteroposterior oblique projection[4] the patient rests supine (Fig. 5A). The occiput elevated by a ray-opaque support (balsa wood or cork) provides maximum flexion of the chin upon the chest. The head is rotated to the side of interest to the extent of 10 degrees, the mouth is held open by a cork and the so-called central ray is projected in line with the external canthus and the external auditory meatus. The resultant image (Fig. 5B) is featured by considerable distortion but ordinarily this projection provides favorable outlines of

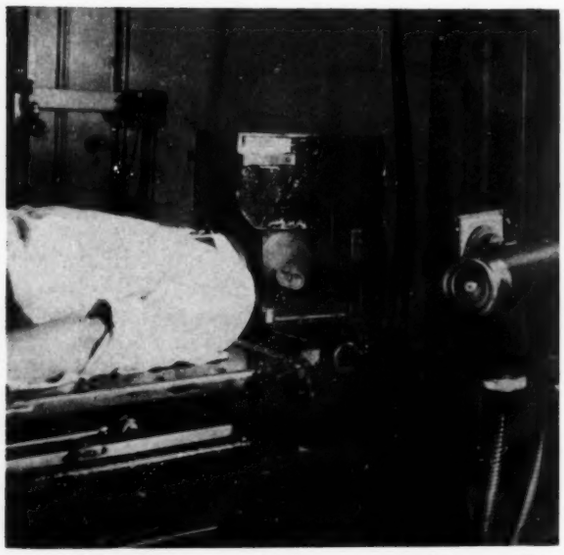


FIG. 4A. Bullitt's mastoid stereoscopic changer. The transparent window in the vise indicates the radiographic portal included. Note the relatively low position of the ear (as compared with higher position used when projecting the mastoid processes). The head is held in a comfortable position but immobilized. The x-ray tube can be shifted from a high to a low position to accomplish third dimensional viewing. It can be rotated to the opposite side to provide for comparative studies.

one plane. It provides for topographic roentgenography. This is accomplished by having the x-ray tube shifting in one direction while the x-ray film is shifting in the opposite direction, the axis of shift being set at the level of particular interest. This procedure has been recommended[1,8,21] for visualization of structures which might not otherwise be clearly discerned.

As in the case of other joints, it has been proposed[10] that positive media be injected into one or both of the compartments of the temporomandibular joint for contrast outline. This procedure is not without risk; in particular, the oily media should never be used.

CLINICAL ASPECTS

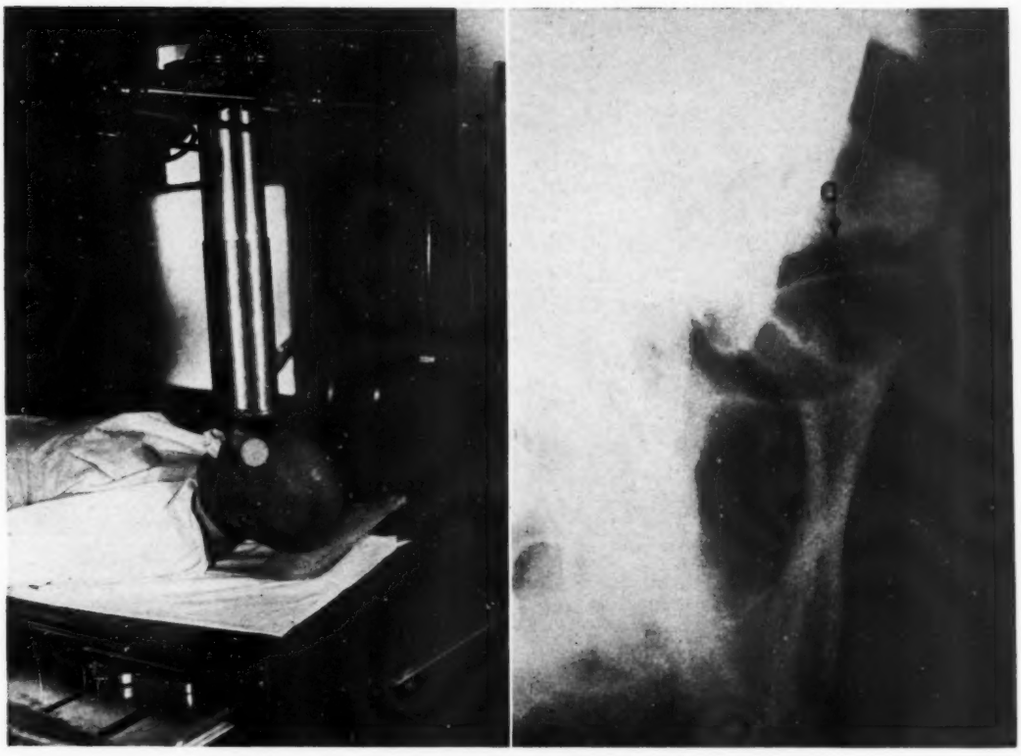
When dealing with joints of the extremities or with those of the spine, it is important first of all to emphasize the embryologic malformations. These are of rare occurrence in the case of the temporomandibular joint although agenesis of a condyle or hypogenesis of a mandible may occasionally be seen. No doubt this sort of deficiency is a major problem even to the maxillofacial surgeon.

FIG. 4B. This study was accomplished with the closed mouth position. Observe: (*a*) outlines of the glenoid fossae; (*b*) outlines of the condyles of the mandible. In the closed mouth position the condyle of the mandible should rest in close apposition to the concavity of the glenoid fossa. Deviation as indicated here signifies a displacement. Third dimensional viewing indicated lateral displacements in this instance.

the opposing articular cortexes, i.e., those of the eminence, the glenoid fossa and the condyle of the mandible.

The principle of tomography is that of blurring out densities except for the image of

Developmental malformations are of somewhat greater incidence. Infection or fracture of the mandible incurred early in life may result in such deformity as to inhibit the development of a condyle. Likewise, with rheumatoid arthri-



5A 5B

FIG. 5. A, anteroposterior oblique projection. Observe the ray-opaque support under the head providing for maximum flexion of the head. Observe the wide-open extension of the mouth supported by cork. The head is rotated 10 degrees to the side under study. The so-called central ray is projected through a plane extending through the external canthus of the eye and the external auditory meatus. B, roentgenographic projection with positioning as indicated in (A). Observe magnified distortion but distinct outlines of (*a*) cortex of glenoid fossa (note irregular concavity in lateral border of it); (*b*) cortex of condyle with eburnation.

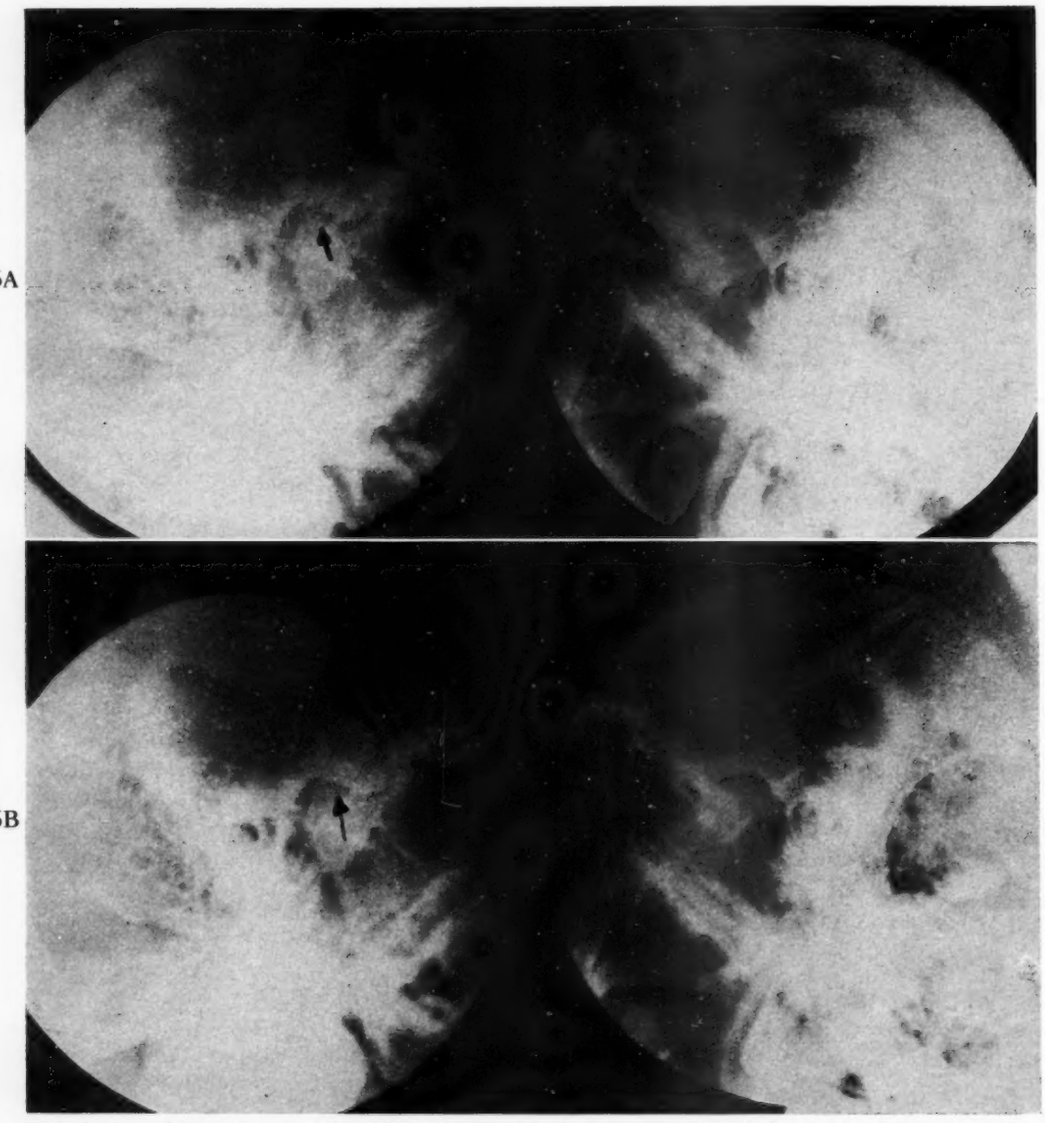
tis involving the temporomandibular joint during the first decade of life (i.e., Still's disease), or where infection has extended from the middle ear into the meniscotemporal compartment or from the mandible into the meniscocondylar compartment during the early years, considerable inhibition of growth may result. No doubt these cases, too, provide great challenge insofar as plastic repair is concerned.

Chronologically, insofar as the development of the individual is concerned, one might next consider the possibilities of osteochondritis, involving the growing cartilage of the condyle or of the temporal bone. Certainly this condition is found regional to almost every other joint in the body. However, I have never run across an example of osteochondritis essentially concerned with the temporomandibular joint and mention this merely as a challenge that we may watch for this type of pathologic condition.

Neither do I know of involvement of the joint by rheumatic fever or other types of allergic arthritis, by gout, ochronosis or primary neoplasm actually involving the tissues of the temporomandibular joint. Surely, evidence of such should be reported if ever identified. As far as I know, there have been no reports of changes in the temporomandibular joints as related to nerve deficiencies, particularly deficiencies in the sensory nerves with resultant "Charcot" changes such as one might expect to occur.

There are four conditions warranting particular consideration: (1) rheumatoid arthritis, (2) infectious arthritis, (3) dislocations and (4) osteoarthritis.

Rheumatoid Arthritis. The determination to live is such that even with pain an individual applies every effort to continue to eat. Likely because of usage of the joint in this way advanced stages of rheumatoid arthritis are seldom found in the temporomandibular joint. However, observers state[3,8,22] that at least 50 per cent of patients suffering from rheumatoid



6A

6B

FIG. 6. A and B, rheumatoid arthritis involving the temporomandibular joints. The projection shown in (A) was made with the mouth closed; that shown in (B), with the mouth open. Note that there has been no anterior excursion of the respective condyles of the mandible. Stereoscopically, there was evidence of a marked degree of generalized deossification; otherwise, particularly on the left side, evidence of absorption of the articular cortex of the condyle and marked irregularities of the osseous articular surfaces.

arthritis elsewhere do experience some degree of disturbance in these joints as well, at least limitation in range of opening the jaw. Actual ankylosis may result. This is exemplified by our patient (E. M., a thirty-two year old man) who first noticed swelling and stiffness of the fingers, wrist and elbows, the shoulders, the knees, ankles and toes some ten years prior to examination. He insisted that these joints bothered him especially under conditions of cold, damp weather. For one year prior to this study there was limitation on opening the mouth. His blood sedimentation rate was increased to 36 mm. per hour. Roentgenography revealed typical atrophy of the soft tissues about the peripheral joints, deossifications and thinning of the opposing articular cortices. There appeared to be some expansion of the joint capsules pertaining to the proximal interphalangeal and intercarpal joints. Observe the studies of the temporomandibular joints accomplished with the closed mouth position versus that accomplished with maximum opening of the mouth. (Fig. 6A and B.) It will be

seen that there was no excursion of either condyle as the mouth was opened; observe also the generalized deossification in the mandible and the cortex of the glenoid fossa and mandibular eminence, the marked irregularities of the opposing cortices indicating dissolution of the articular cartilages and the surfaces of the bony cortices. Note the close apposition of the bony structure of the condyle in relation to the temporal bone. This patient was unable to open his jaw more than an interincisoral opening of 1 cm.

Infectious Artbritis. With the advent of antibiotics this type of involvement is of relative rarity. However, we must recognize the fact that infections do extend from the middle ear into the temporal compartment and that they do extend from an infected tooth into the substance of the mandible or due to a compound fracture, by that route upward into the mandibular compartment producing true infectious arthritis. Of course infection may localize in the joint itself hematogenously or it might be introduced by way of injection, perhaps in connection with contrast visualization of the joint or in connection with the recently advocated injection of compound F to reduce pain. Infectious arthritis roentgenologically is characterized by limitation of or lack of excursion of the condyle on the affected side, increased spacing between the opposing cortices (due to fluid), hyperemic deossification beneath the subchondral cortex adjacent to the compartment involved, and ultimately by erosion of the articular cortex. Usually there is some evidence of destruction of the adjacent osseous structures—evidence of actual osteomyelitis. Of course a considerable degree of periarticular swelling is to be expected as well as prominence of the parotid gland and corroborative evidence of systemic reactions including fever and leukocytosis.

Dislocations. Dashboard injuries so frequently encountered in this day of reckless driving particularly account for dislocations of the temporomandibular joint—no doubt one of the most common derangements confronting the maxillofacial surgeon. This type of involvement might be exemplified by our patient (F. N., a twenty-eight year old man) who was driving his automobile at a speed of 30 to 40 miles per hour when the car in front of him suddenly stopped. To avoid collision he swerved toward the curb and collided into a telephone pole. His chin struck the steering wheel. The postero-anterior projection (Fig. 2B) revealed a vertical complete fracture involving the symphysis menti, fractures through the neck of the mandible on each side and obvious dislocations of the condyles. The fronto-occipital projection (Fig. 3B) substantiates this lateral shift of the condyles. The stereoscopic study (Fig. 4B) accomplished with Bullitt's mastoid changer, made with the mouth of the patient closed, indicated that particularly on the right side the glenoid fossa was unoccupied; third dimensional viewing visualized the condyle to be lateral to the mandibular eminence. To a lesser degree, the same deviation was revealed with respect to the left temporomandibular joint.

With most dislocations,[6–8,16] the condyle of the mandible is shifted anterior to the mandibular eminence; otherwise the displacement may be lateral, medial to the glenoid fossa or even posterior to it. There are several conditions which predispose to repeated dislocations, namely, a shallow glenoid fossa, a shallow mandibular eminence and a loose joint capsule as might result from previous trauma or disease in the joint. Such consideration might be of importance in case litigation is instituted because of inadvertent dislocation during handling of a patient. A mere overbite such as that incurred while attempting to close the mouth after engaging a wide bite of an apple may cause anterior dislocation of the condyle. Such displacement is not uncommon in connection with placement of a mouth gag during anesthesia.

Osteoarthritis. Degeneration of the opposing articular cartilages and possibly also of the meniscus may develop as a result of any of the three major conditions so far considered, i.e., following rheumatoid arthritis, infectious arthritis or dislocations. It may result from abnormal development of the mandible or from repeated minimal trauma. Several observers[11,17,18] emphasize that this type of disturbance is common and that it is usually attributable to malocclusion, particularly as a result of loss of molar support on one side. Some[11,17] believe that the mere wearing away of the cusps of teeth with resultant overbite is sufficient to produce it. The dental profession is especially alert to this type of arthropathy of the temporomandibular joint. Evidence of dental deficiency as considered suffices to prompt their considering an associated pathologic disease in the joints.

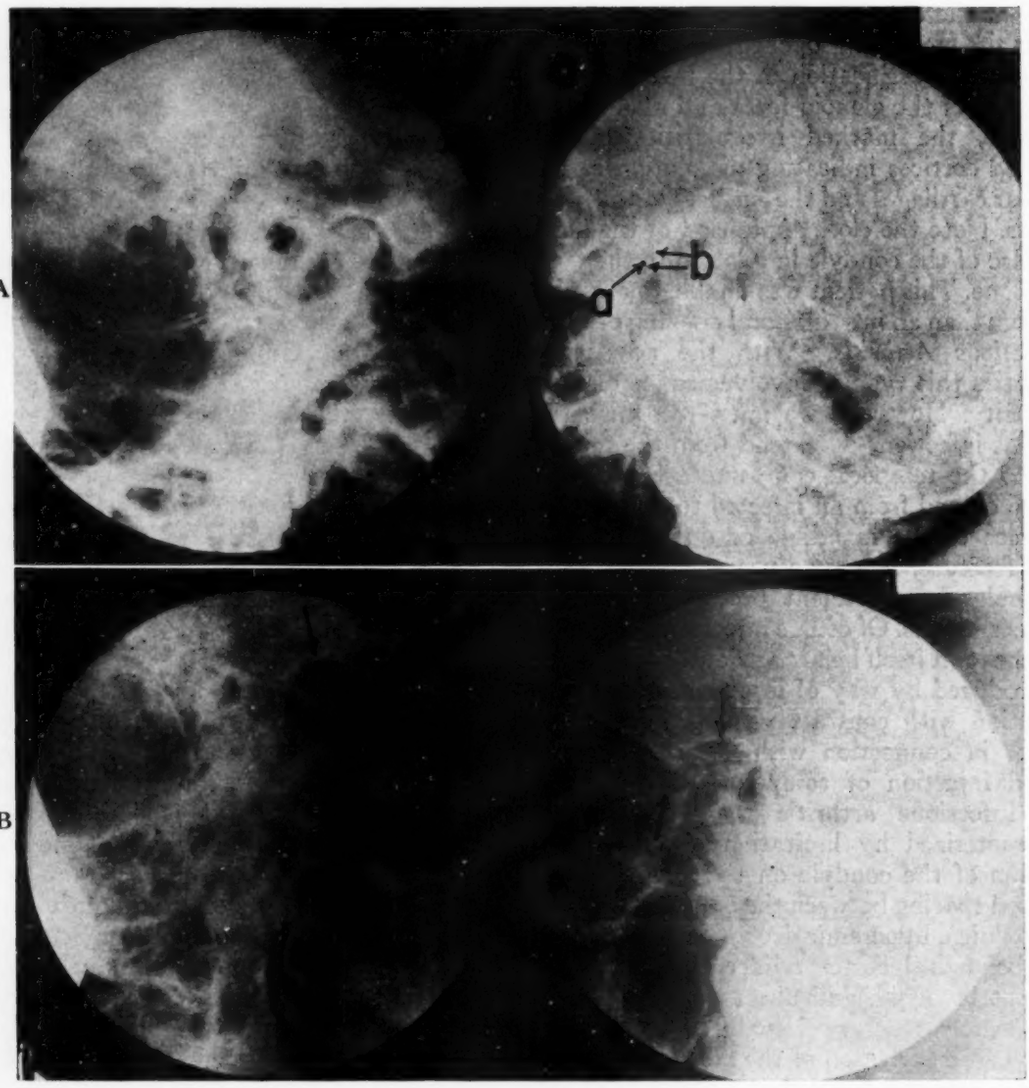


FIG. 7. A and B, osteoarthritis of the temporomandibular joint. The projection shown in (A) was made with the mouth closed; that of (B), with the mouth open. Note that on the right side, with the mouth closed, the condyle of the mandible has shifted to a relatively *posterior* position. Otherwise, observe: (*a*) eburnation and irregularities of the articular cortex of the condyle and (*b*) reduction in the cartilaginous spacing of the joint indicating wearing away of the articular cartilages and the meniscus; also the eburnation of the apposing cortex of the glenoid rim. Figure 7B indicates limitation in the anterior excursion of the condyle on the right side as compared with the left (outlines of respective glenoid fossae and condyles indicated by arrows).

Goodfriend[17] and Costen[9] deserve credit in particular for warning us as to the many varied and seemingly extraneous clinical manifestations which might be associated. Although contradiction has arisen[13,23] as to the proper explanation for manifestations seemingly unrelated to the temporomandibular joint, it does seem practical to record some of these. Costen[11] for instance has noted such subjective symptoms as: otalgia and pain in the mandibular joint; pain about the eyes, cheek or parietal region; frequently lancinating, tic-like, burning soreness or drawing pains in the tongue or pharnyx; pain in the occiput, vertex or neck; perioral burning; pain along the lower jaw; and painless reactions including crepitus, tinnitus, deafness, vertigo, stuffiness in the ears and illusions of copper and salt tast. As objective features he has listed the following: tenderness of mandibular joints to internal palpation, shift of the lower jaw or condyles laterally or backward, maloccluding natural teeth, edentulous

jaws, partial loss of molar teeth, trismus (total or partial restriction of motion of lower jaw), herpes of the buccal mucosa or external auditory canals, reduction in saliva, increase in saliva and dissimilar metals in fillings producing galvanism.

May I exemplify this condition by one of our patients (L. H., a thirty-eight year old man) whose complaints were difficulty of hearing with his right ear, burning, tingling pains on the right side of his tongue and aching in the temporal and occipital regions. As our studies were being accomplished, we noted that he had lost the three molars and bicuspids from his right upper jaw. Upon questioning he stated that these had been extracted approximately three years prior to this examination. Observe in the closed mouth study (Fig. 7A) the relatively posterior position of the condyle of the mandible on the right in relation to the glenoid concavity. Also note the flattening of the condylar surface and the eburnation. In the open mouth study (Fig. 7B) observe the limitation of excursion of the condyle on the right as compared with that on the left and otherwise more definite visualization of the flattening of the head of the condyle, the eburnations and marginal spur formations.

No doubt many of these manifestations of osteoarthritis are experienced by patients who have dislocations without replacement of the condyle of the mandible to its proper location.

SUMMARY

The temporomandibular joints are unique. They are characterized by complicated anatomy and physiology. Reliable examination of them is difficult. Various roentgenographic projections are suggested.

Five types of involvement to be considered in the temporomandibular joints are (1) embryologic or developmental malformations, (2) rheumatoid arthritis, (3) infectious arthritis, (4) dislocations and (5) osteoarthritis. Generalities are discussed pertaining to each of these and case examples are presented.

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INFANTILE CORTICAL HYPEROSTOSIS

A NEW SYNDROME

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THE differential diagnosis in cases of swelling of the face is important to members of both the medical and dental professions. To the list of differentials already confusing us, a new malady has been added. Caffey and Silverman[3] described a syndrome in which "tender swelling" of the face was a prominent feature. Articles on this subject have appeared for the most part in journals devoted to pediatrics or roentgenology and, as a consequence, the syndrome has not been described in the oral and plastic surgery literature so far as is known. The term "infantile cortical hyperostosis" or "Caffey-Smyth syndrome" has been given this new group of findings. Three features are commonly observed in these patients: (1) tender swelling deep in the soft tissues, (2) cortical thickening in the skeleton and (3) onset during the first three to six months of life, although cases have been reported as late as twenty months. The soft tissue swelling is deep and firm; there is no pitting on pressure, no undue heat or discoloration. Occasionally lymphangitis or lymphadenitis occurs in conjunction with the swelling, the latter always being noted at the same time as the hyperostosis.

In these cases, the bone most frequently involved is the mandible; however, the clavicle, scapula, ribs and tubular bones of the extremities also can be affected. The involved bone shows cortical hyperplasia under a proliferating periosteum. Usually several bones are affected in the same individual but cases have been reported in which only one bone has been involved.

Clinical Course. The course, as previously noted, ordinarily begins anywhere between birth and twenty months, and the active manifestations usually last from eight weeks to nine months. There may be remissions of facial swelling or other intermittent symptoms.

It has been observed that a striking paucity of constitutional systemic manifestations exists in all stages of the disease. There may or may not be fever; the temperature curve may assume almost any pattern although the temperature itself rarely exceeds 193°F. Oddly enough, some of the cases that manifest the severest clinical findings carry a relatively low temperature curve. "Visible" and "palpable" tender swellings have been present in all cases and constitute the most consistent observation. One usually has to obtain the date of onset of the swelling from the parents which doubtless accounts for the varying descriptions seen in the literature. However, it is thought that the swellings occur rather rapidly and subside very slowly. The most common sites of swelling of the face are the areas anterior to the parotid region and at the angle of the jaw. No intraoral changes have been noted to date and the overlying skin appears normal. Although the mandibular hyperostosis with its overlying deep tender swelling is seen most commonly, it is possible for only one extremity to be affected, without facial involvement, and vice versa. The onset of the disease usually is accompanied with hyperirritability of the child, also crying, or other signs of pain on movement of the involved part associated with some type of fever.

Laboratory Findings. Anemia, an increased sedimentation rate and leukocytosis are the most common laboratory findings to date although blood serology, ascorbic acid determinations (urine and blood levels), agglutination tests, blood cultures and calcium, phosphorus and phosphatase tests should be done to rule out other causes. Biopsies of the affected part show hyperplasia of the lamellar cortical bone with no evidence of subperiosteal hemorrhage or inflammation. There are definite changes in the tissues adjacent to the hyperostotic areas, usually atrophic degeneration of musculofascial structures.

Roentgenologic Findings. The basic change is external thickening of the cortical bone, some-

times lamellated. These changes usually are demonstrated from two to five weeks after the appearance of the soft tissue swelling. It can be differenetiated from scurvy because of the subperiosteal hemorrhage, also because periosteal thickening starts at the cartilage shaft joint in the latter condition, and the usual area of osteoporosis at the provisional line of calcification that is seen in the long bones is not present in infantile cortical hyperostosis as it is in scurvy.

Rickets also has to be differentiated and the characteristic club-shape appearance, due to the widening of the epiphyseal plate with the cupping and irregularities seen there, should serve to help us tell the difference.

Lues is another radiologic diagnosis that could confuse one, but a negative serologic test, rarity of luetic involvement of mandible and absence of osteochondritis should enable us to make a correct diagnosis.

Perhaps one of the most common conditions confusing us today is the excessive use of vitamin A causing toxic symptoms and signs not unlike those of infantile cortical hyperostosis. The radiologic picture can be almost the same although hypervitaminosis A usually has a predilection for the ulna. A high plasma vitamin A level and the cessation of signs and symptoms after removal of vitamin A should clear up the situation.

Radiographs do not support the theory of vitamin deficiency.

Etiology. Insofar as etiology is concerned, lesions of osteoperiostitis may be classified as inflammatory, traumatic, metabolic or neoplastic. In all probability, inflammation is the most likely choice as to cause since in almost all of the cases reported fever has been a symptom. Kane and Borzell[1] have suggested, this new syndrome really may be infectious osteoperiostitis. Careful prenatal and familial histories have not yielded any information of importance.

Differential Diagnosis. The age of the patient and the onset usually render the disease difficult of diagnosis in its early stages and, at the same time, one has to think of parotitis, hypervitaminosis of vitamin A, osteomyelitis of the mandible, neoplasm of the mandible, scurvy, rickets, leukemia "with the anemia and fever that exist," rheumatoid arthritis and syphilis.

Prognosis. The disease is self-limiting, ending after several weeks, usually without complications. Persistent facial swellings and diaphragmatic paralysis have been reported in some cases. The cortical thickening gradually subsides and after a few months disappears completely. There has been recovery in practically all cases reported to date. The use of antibiotics, chemotherapy and other forms of treatment has been of no value.

CASE REPORT

O. M. M., a colored female child, was an apparently normal infant born after eight and a half months' gestation to a fifteen and a half year old colored female with a positive serologic reaction. There was no complication at birth. She was discharged from the hospital along with her mother after a period of six days. In November, 1950, at the age of eight months, she was hospitalized for two weeks because of "swelling at the angle of the left jaw" of two weeks' duration. History by the mother disclosed the fact that the patient had been fretful for about two weeks simultaneously with swelling of her left jaw. She had been seen by her local physician who gave her penicillin. She ceased fretting and the swelling disappeared only to return to a greater extent.

Physical examination was negative except for the tender swelling of the left jaw, extending from the angle of the jaw to the corner of the mouth. The impression was cellulitis of the jaw. The blood serology was negative, as were other blood chemistries. X-ray of the jaw showed periostitis with cortical hyperplasia. Treatment consisted of penicillin, and after two weeks the patient was discharged improved. The diagnosis was periostitis of the jaw, left, probably luetic.

The child was again admitted to the hospital in July, 1951, for six days with the chief complaint of recurrent painful swelling of the left jaw. At this time she was fourteen months old. The history revealed that the child had been comparatively well since her previous admission until three days prior to the present admission when stiffness and tenderness of the angle of the left jaw developed. The child was listless and had anorexia. On the day prior to admission she had some fever.

Physical examination revealed rectal temperature of 102.4°F. The remainder of the examination was negative except for an en-

largement of the cervical nodes, with slight tender swelling at the angle of the left jaw.

Laboratory data were as follows: hemoglobin 9 gm., red blood cells 4,100,000, white blood cells 25,000, with 70 per cent polymorphonuclears. The urine showed 1 to 2 pus cells. The sedimentation rate was 62.

X-ray showed some cortical thickening of the left mandible. The periosteal reaction had subsided since the last admission. The long bones gave the appearance of healing rickets. After the temperature became normal, she was discharged, improved, returning five months later with no signs of disease.

COMMENT

At first we thought we might be dealing with luetic periostitis because of a positive maternal serologic test; however, no positive serologic reaction was obtained from the baby in this case on repeated examination and no other laboratory or physical finding substantiated this diagnosis. Also, lues of the mandible is rare.

We concluded that the case fell into the realm of the Caffey-Smyth syndrome. We are reporting the case because it brings out the following pertinent points: (1) The disease can be limited to the mandible alone. (2) There are symptom-free periods with recurrent bouts of original signs and symptoms. (3) An additional case that developed after eight months instead of the usual three, as reported in the literature, comes to light.

No attempt has been made in this paper to bring out any point concerning the disease that has not been already reported elsewhere. Only a brief summary and one case report are presented in order to familiarize our surgical specialists further with this new syndrome when dealing with facial swellings.

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DOUBLE PIN FIXATION IN FACE AND JAW FRACTURES

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PARKHILL'S bone clamp[4] introduced in 1897 seems to have been quickly abandoned. With the advent of the antibiotic era its use again became feasible. It is now about fifteen years since Roger Anderson[1] reintroduced this principle of double pin fixation to orthopedic and general surgery. It is about the same time since Stader[5] reported its use in veterinary surgery. It is ten years since Converse and Waknitz,[2] then with the American Hospital in Britain, introduced double pin splinting to jaw surgery.

The enthusiasm with which it was first received has descended to a complete rejection in many quarters and a guarded acceptance in others. The method seems to occupy a definite, although small niche in the treatment of face and jaw injuries. It is of specific help in the management of some problem fractures.

During the past ten years double pin splints have been used in the treatment of maxillofacial injuries at the Montreal General Hospital. This hospital is in a turbulent part of the city with a large slum and dockside casualty practice which brings in about seventy-five jaw fractures a year. Of 750 fractures over the ten-year period since the introduction of double pin fixation, 110, or 15 per cent, have been double pinned. It might be of interest to review the evolution of the method and the splints that have been used.

There have been changes in method and material. These include (1) the type of pin, (2) the drill for insertion and (3) the apparatus used to hold or retain the pins.

TYPE OF PIN

The type of pin used has been the key to success or failure. The earlier pins were bi-bevelled bits of Kirschner wire which were crossed before insertion. These quickly loosened to come away in the fingers and might or might not have held the fragments in position long enough for the soft tissues to take over. Then came a smooth tri-bevelled pin that was introduced into the bone with a to-and-fro motion which merely burnished a smooth hole and allowed the pin to loosen in three to four weeks. These types of pin were responsible for most of the failures and complications of pin loosening. Later pins were larger in diameter with a tight thread requiring drill preparation of a hole in the bone to receive the pin. They were difficult to apply and resulted in unnecessary scarring. Finally a pin was evolved with an ordinary screw thread. It was simply screwed into the bone much as one would apply a wood screw to a soft pine board. These pins hold snugly for as long as three months and on removal have to be screwed out with a drill. Since then calibrations have been added to the pin shaft providing a guide to depth insertion.

It became apparent early that the pins should be carried through both cortices of the bone with their points embedded into the soft tissue of the floor of the mouth or on the medial aspect of the mandibular ramus. It was also found that better traction and fixation resulted if the pins were inserted at a broad angle and not crossed before insertion.

DRILL USED FOR INSERTION

The Archimedes drill, popular in England, has a to-and-fro motion which precludes or makes difficult the use of a screw thread and gives a burnished bone hole from which the pins quickly loosen. This drill may have been responsible for a lot of the dissatisfaction with the double pin method in England and South Africa, where complications of pin loosening, pin seepage and even sequestration seem to have dogged the method.

The hand drill, of an awl type, first used when the method was introduced in America, was slow, tedious and tiring. One kept an unsterile finger of the left hand inside the mouth to brace the bone fragment against the drilling point which was inserted externally by the sterile right hand. At the end of the insertion of a six-pin job, both hands were exhausted. This drill is still the instrument of choice for pin removal.

In an effort to speed up the process, an electric drill with pen grip handpiece was used. This proved too rapid and difficult to control.

At present, a pistol-grip, ratchet type of drill which quickly and easily screws the pin into the bone, is the instrument of choice.

ASSEMBLY APPARATUS

In the middle war years, a profusion of apparatus, some of which had not much reason for existence, flooded the market. At first it was thought better if the pins were crossed before entering the skin. At this stage the author humbly contributed a piece of equipment which was abandoned to the more expert craftsmanship of the instrument maker after a short life of three or four cases. They, also, produced some monstrosities. The Thorold splint, the Haynes Griffin splint, the Berry-Legg splint, the Stader splint, the Clouston Walker splint and modifications of the Roger Anderson splint quickly came into use. In this country a modification of the Roger Anderson splint, as conceived by Stout and Fairbank, seems to have withstood the test of time. In England the Clouston Walker splint held preference. Simplicity and universality of joint assembly seems to have been the key to success.

INDICATIONS FOR DOUBLE PIN SPLINTING

Following Converse and Waknitz' work in 1941, the profession began to wonder if this might not be the "cure-all," the method "par excellence" for the treatment of all jaw fractures. It soon became evident that this was not so. The method was not as easily applied and it was not as certain as the tried and tested methods of dental fixation. These methods, by securing the occlusion of the teeth which is the guide to correct reduction, accurately and expertly fix or splint about 80 per cent of mandibular fractures. And so the double pin method was immediately relegated to the treatment of about 20 per cent of edentulous fractures. Here it found definite use and indication.

Soon it became evident that this was not the "cure-all" that had been hoped for, even in this type of fracture. In the first place the method was "blind," i.e., one manipulated and hoped the correction was right only to find later that it was not and that readjustment was necessary. In the second place, most edentulous jaw fractures with displacement, and especially those of several days' duration, had tissue between the displaced bone ends and no other method but open operation would give accurate reduction. Thirdly, in some fractures with muscular pull on one fragment the fixation apparatus did not prove sufficiently strong enough to maintain the correction and the splint adjustment slipped or the pins "migrated" through bone with reproduction of the deformity.

With the advent of available penicillin in 1945 our fear of precipitating bone infection by open operation disappeared and it became feasible to reduce and wire jaw fragments openly without the anathema of osteomyelitis. This took another 8 or 10 per cent of fractures away from the double pin method. However, these open operations on the mandible have their hazards and objections. They may leave an unwanted scar and occasionally the lower branch of the facial nerve may be damaged. At times, after weighing these pros and cons, the double pin method won out over such operations.

With this narrowing of the field of indication for double pin splinting one wondered just where it might come into use wisely. It was not necessary to search far. The method is helpful and useful in the treatment of about 10 per cent of jaw injuries. It has actually been used in 12 per cent of our last one hundred consecutive lower jaw fractures. The indications are often clear cut and may be cited as follows:

Certain Fractures in Children. Children's teeth are frequently absent and if present are bell-shaped making dental fixation difficult and impractical. One hesitates to do an open operation on the growing mandible if a procedure of less severity is available. Such a case is the child who falls from a balcony or is kicked by a horse with resulting fracture at the symphysis. Double pinning will splint the fracture of the body of the mandible; and if the pins are carefully inserted low down, one need not fear injury to tooth follicles. The youngest case so treated was a child of eighteen months. Others of three, five and seven years have been satisfactorily handled.

Certain Fractures in the Aged Edentulous Patient. The endentulous, brittle mandible of the aged patient is often broken in many pieces. With their lax tissues of the face there is often

swelling to alarming proportions. Because of this multiplicity of fracture and excessive swelling, open reduction presents a difficult problem. Absolute accuracy in the realignment of their fragments is not of such paramount importance as they wear dentures which can be adjusted to accommodate a mild deformity. However, fixation is important and double pinning, which is reasonably simple in its application and also reasonably accurate, will usually provide an adequate means of fixation. The oldest patient so treated was eighty-two.

Fracture of Any Edentulous Mandible. These require open reduction, circumferential wiring or double pinning and in about half of the cases in which treatment was directed by the author, double pinning has been preferred.

Fracture of the Tooth-bearing Mandible with an Edentulous Upper Jaw. Although cap splints may be used, the same principles generally apply as for treatment of the edentulous mandible and double pinning is found useful in about half of such cases.

Fragmentation Fractures. With bad fragmentation of the lower jaw, double pins can usually be inserted into the major fragments which are so fixed allowing the minor fragments to heal around them.

Fixation in Bone Grafting Operations. Double pinning may be an adjunct to direct wiring or may suffice in itself to hold the fragments. It may be used to hold a bone space open while bone grafting is contemplated.

Edentulous Posterior Fragment. One would be remiss in not mentioning this problem fracture in the treatment of which so much was expected of the double pin method. It has not let us down completely. Pins are not as secure in the angle or ramus of the mandible as in the body and they may "migrate." Muscle pull of a badly displaced fragment is sometimes too much for the apparatus. Open reduction has been our choice of method with occasional resort to double pin splinting when the fracture line seems more favorable.

Fractured Upper Jaws. If forward traction is necessary and there are not sufficient teeth to use a reverse Kinglsey arch, double pin splinting or internal wire fixation becomes very helpful. We either insert a double pin unit at the base of the nose into the maxilla where it is thickest, just above the alveolar process, or transfix the whole upper jaw with a Kirschner wire or pin and use this as our *point d'appui* for attachment to a plaster headgear.

Fractured Cheek Bone. Double pins have been used in two cases but the method is not recommended. The pins must be placed well laterally in the body of the zygoma and too frequently there is not enough bone intervening between the antrum and the orbit to provide lodgment for the pins. Pin scarring on the cheek prominence may be unacceptable. If fixation of this type of fracture is necessary, the author prefers the method of securing a wire about the infraorbital margin which was introduced in 1938 and has been used routinely since.

REMOVAL OF PINS

The pins are removed from about the twenty-first day onward. Even in the children so treated an anesthetic has not been necessary. The hand, awl type of drill is used, fixed securely to the pin end and rotated gently outward. There is only slight momentary pain or discomfort at the first twist and possibly, if the pin is allowed to sag, as it comes away from the soft tissues.

COMPLICATIONS

Complications of aneurysm between the facial artery and vein, osteomyelitis, pinhole sequestration, pin loosening, pin seepage, etc., have been reported. Aside from a little pin seepage and pin loosening early in our experience with some of the earlier pins, none of these have been seriously present in our series of cases. One has to avoid tooth roots and fracture lines. The pin sites and pinholes are given no special attention aside from wrapping the pin about its point of entrance with sulfathiazole emulsion gauze for five days. The holes are painted with an antiseptic on pin removal. Pin scarring has been a little objectionable in a very few cases but we have always believed the scarring to be less with this treatment than if open reduction were resorted to.

Objection has often been raised in the literature to the external position of the apparatus and its bulk. The apparatus has been well tolerated and our patients have been comfortable. They seem to be proud of it and often return to their work or way of life within two or three days. Possibly the fractured jaw so

long unnoticed with its intraoral splints is now receiving the publicity it deserves.

CONCLUSIONS

Double pin splinting is useful in the treatment of about 10 per cent of face and jaw fractures. These are the problem types of fracture that were less satisfactorily treated by other methods. With a screw type of pin and certain precautions in their insertion, complications of pin loosening, seepage and bone infection are not expected. The method in no way competes with other methods which are available for fixation.

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When an arterial defect is present in a small artery, it can usually be "bridged" by transplantation of a suitable piece of vein from the same patient (homograft). However, when a larger artery, as the aorta, needs a graft, one must secure a suitable piece of artery from another of the same species so that it will withstand the arterial blood pressure and not cause thrombosis or an undesirable reaction in the tissues surrounding the site of the graft. (*Richard A. Leonardo, M.D.*)

THE PROBLEM OF MANAGEMENT OF THE PREMAXILLA AND PROLABIUM IN CLEFT PALATE PATIENTS

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THE premaxilla and prolabium arise from the frontal-nasal process and join with the uniting maxillary processes to form the upper jaw and lip about the seventh week of fetal life. Failure of union, complete or partial, results in varying degrees of cleft lip and palate. A bilateral cleft lip and palate presents a special problem.

Those of us interested in cleft palate rehabilitation are trying to learn what is best for the patient. There are many opinions regarding the handling of a bilateral cleft lip and palate, but there are two main differences. Before we can discuss these differences we should understand some facts related to this problem. (1) The premaxilla contains the deciduous and permanent first incisor teeth. Occasionally it will contain a second incisor tooth. The missing tooth or teeth must be replaced by a denture. Many times the erupted teeth are malposed and are replaced at the same time. (2) The prolabium *per se* does not contain muscle because embryologically the cleft exists before muscle formation starts. Muscular movement of the prolabium is accomplished by its union with the lateral borders of the lip. (3) The seventh nerve has no way of reaching the prolabium except through this union. The sensory nerve supply and vascular elements come from the nasal palatine route and are the sole support of the segment until union is established.

Under normal conditions the upper lip is formed and the premaxilla loses its identity between the maxillary bones. The counteracting pressure of the lip and the tongue mold the alveolar bone growth of this new structure. In the unoperated cleft the labial forces are lacking and the premaxilla protrudes, while the buccal forces constrict the lateral segments and result in a bilateral cross bite.

Surgical intervention as far as alveolar molding is concerned gives us a varying result dependent upon the position, elasticity and muscular power of the united lip. The main differences in lip surgery are in the use of the prolabium and its inferior vermilion and mucosa. Preservation of this structure results in a more equal labial-lingual molding balance and destruction of it increases the labial forces and results in lingual version of the upper anterior teeth.

Another main difference is in the treatment given the protruded, twisted and elevated premaxilla. It has been resected, retroposed and molded backward forceably and gently. Resection is in disfavor except in late unoperated cases. Retroposing is accepted as long as the segment is not tilted backward and the cuts do not transect the nasopalatine vessels and nerves. This is done by making an oblique cut or excising a block or wedge of septum at least 1½ cm. posterior to the premaxilla. It is generally agreed in rehabilitation groups that retroposing should be used only in extreme cases in which it is impossible otherwise to close the lip. Lip closure is most universally used to guide the positioning of the premaxilla. I agree that there is a temptation to use a heavy thumb in some cases. Even in these cases the desired result will be obtained if a two-stage closure is used. A secondary lip repair is always necessary, so a pulled lip scar is not an issue.

There are three criteria to meet in considering lip surgery. We strive for: (1) a mimimal lip scar, (2) mimimal associated nasal deformity and (3) a lip that is equal and full.

A minimum scar can be obtained by making accurate incisions, carefully suturing the opposing segments and instituting meticulous postoperative suture line care. The latter is, I believe, the most important part of cleft lip surgery. The success or failure is in the hands of the nurse caring for the patient.

The associated nasal deformity is our most difficult problem. It stigmatizes a cleft patient as surely as does his defective speech. All we can accomplish in initial surgery is to equalize the floor of each nostril and position each ala

symmetrically. A Z-plastic to lengthen the columella as advocated by Straith can be done a few years later on the more severely affected side. A total rhinoplasty usually is required before the stigma is completely erased.

A full and equal lip can be accomplished only by preserving the inferior mucosa and vermilion of the prolabium. It makes little difference whether you approximate the segments by simply paring the opposing surfaces or use complicated geometric designs. The growth of the prolabium must not be restricted by suturing the lateral borders under it as you would in a bilateral Blair-Mirault or Le Messurier procedure. Tennison's stencil method is satisfactory in cases in which there is a large prolabium. Surgeons such as Davis, Vaughn, Shultz, May and Curtis have long advocated the preservation of the prolabium with its inferior vermilion and mucosa. This small tab of tissue, if unrestricted, will grow in length and assume its proper position between the lateral segments of the lip.

Its growth, however, is dependent upon the lack of interference with its blood supply in the preservation of the premaxilla and the use of non-traumatic procedures to retropose the premaxilla. This is a key point in the re-evaluation of our past cases in which we compare the preservation with the destruction and the end results.

Almost all primary lip repairs done in infancy require a secondary repair. It is impossible to anticipate the extent of growth that will result in any segment of the repaired lip. This secondary repair can be done in three to four years, or it might even be deferred until the patient will cooperate with your efforts to minimize the lip scar. By striving for a full lip we avoid the constricted upper lip that so frequently requires an Abbe procedure. By not restricting the downward growth of the prolabium we avoid the "bunched" tissue that we see beneath the columella. Some argue that this bunched-up tissue can be used to good advantage in the V-Y construction of a columella which is most always necessary. A V-Y construction done in a case in which the prolabium has been allowed to grow reduces the over-all lip deformity by narrowing each nostril floor and positioning each ala, in addition to reducing the fullness of the lateral portions of the lip. The secondary lip repair can then be done a year or two later to accomplish the desired result. Usually all that is required, then, is the excision of a diamond-shaped piece of tissue at the vermilion border to eliminate the notch and narrow the suture-line. An Abbe procedure can always be performed if necessary or the lips can be equalized, if not accomplished by orthodontia and prosthesis, by excising a portion of the lower lip.

I will leave the discussion of total palate surgery to others and confine my remarks to the premaxilla. The closure of the hard palate whether done by mucoperiosteal flaps, bone flaps or by Vomer turnovers usually leaves the premaxilla unattached or floating. Proper lip surgery will position it without too much posterior displacement. Our best results are obtained if small flaps similar to Vomer flaps are used whenever the segments are close enough to be swung across.

It is nice to have the premaxilla stabilized but it is not necessary. As I stated before, a prosthesis is always needed because teeth are missing and will have to be replaced. Most prosthodontists prefer to ignore the teeth present rather than include them in the positioning of the anteriors. Some cover them with thimble crowns but most often they are removed and even the labial plate of the premaxilla is resected to allow the positioning of the teeth without undue prominence. Many times a skin graft can be used to extend the labial sulcus which will, in addition to allowing a labial flange on the denture, free an attached and restricted lip. Orthodontia can be helpful in rotating malposed teeth in the premaxilla or positioning it for surgery. Operation performed this late will not stabilize the segment as union will be that of mucoperiosteum only; however, it will improve oral-nasal hygiene if food is prevented from going to the nasal cavity. Closure of sublabial perforations and the later extension of the sulcus with a skin graft will also be helpful.

SUMMARY

Lip surgery should meet three criteria, that of minimal scar, minimal nasal deformity and fullness to the lip. This can be accomplished by preserving the inferior vermilion and mucosa of the prolabium. A V-Y columella construction can be performed, followed by a secondary repair of the lip and rhinoplastic procedures. The premaxilla can be stabilized

when the Vomer turnovers are done at approximately one and a half to two years of age or they can be ignored and partially resected in adulthood. A skin graft ridge extension is useful in freeing an attached lip and allowing the seating of a denture with a labial flange.

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EXPERIENCE WITH THE PHARYNGEAL FLAP OPERATION

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THE purpose of this paper is to relate briefly the author's own experience with the pharyngeal flap operation in a small series of cases. The indication for the operation in these cases will be discussed, as will be a few points in operative technic. The indications used by other surgeons for choosing the operation will be compared with our own. The results of this type of surgery are difficult to evaluate and are commonly expressed only as a clinical impression although the use of recordings allows detailed analysis by speech therapists.

So many considerations are of importance in the surgical treatment of cleft palate that it is difficult to consider a single function, but we will at this time think only of speech production. For normal speech it is necessary to have adequate, controllable velopharyngeal closure. This has proved an elusive goal. Progress in surgical thinking has largely eliminated the "brute strength" school of palatal suture, with its tragic failures. Antibiotics and improved anesthesia have eliminated many surgical accidents. Palate-lengthening procedures have been given close attention by most workers in the field, many of them stimulated by the work and teachings of Dorrance. Again, however, considering the desired result of normal speech, the percentage of failures remains high.

It is not necessary at this time to review the history of the pharyngeal flap operation except to express some wonder at the waxing and waning of its popularity during sixty or seventy years of use.

Padgett made the first and most extensive use of the procedure in this country. In his reports the emphasis seemed to lie on the operation as a method of supplying ample soft tissue to close a badly damaged palate. In very recent years the reports of Moran,[2] Conway,[3] Dunn[4] and others have encouraged the rather widespread use of the pharyngeal flap operation, and accurate evaluation of its worth should soon be achieved.

The patients I selected for this operation are of a type familiar to all. They had palates which looked very nice. They could blow feathers all over the room and suck sodas through long straws. Most had had speech training, several had had palate-lengthening operations and none seemed to offer further anatomic indication for the latter operation. All had unsatisfactory speech, varying from fair to unintelligible.

Ten such cases form the basis for this report. The age range was from ten to thirty-three years. All of the operations were performed under general anesthesia, with orotracheal intubation. The anesthetist was asked to select a tube somewhat smaller than that which would normally be used, and preferably with an inflatable cuff. No technical difficulty was noted from the presence of the tube and no anesthetic complications were encountered. Dramamine was used in several cases to combat postoperative nausea and retching.

The flap was based up in one case, down in all others. An effort was made to maintain a length-width ratio of roughly 2:1. The retraction of the flap after it is freed from its bed makes it seem disconcertingly small. It should be sutured in place under normal tension; the hinge flap turned back from the soft palate should be as long as is consistent with viability.

There were no failures of attachment and no postoperative complications. There have been no late complications in this small series.

All of the patients have obtained definite improvement in speech. Such results may be interpreted as wishful thinking on the part of the surgeon. It is of value to wait for a voluntary expression on the part of the relatives; then one may ask for the opinions of the nurses, house staff and others familiar with the patient. Someone will usually be brave enough to tell the truth. Of course, facetiousness aside, recordings should be kept of all patients for complete evaluation by speech therapists. We have been unable to achieve this goal but do have several recordings.

A few points merit amplification. The improvement in voice obtained by the pharyngeal flap operation has uncovered, in several cases,

other speech defects. Irregular dentition produces lisps and hissing sounds; a tight lip may catch on a tooth far out of line with similar effect. Rapid and slurring speech, due to improper breathing, is a common fault despite previous training.

If we accept the fact that the pharyngeal flap is a valuable adjunct in the surgical treatment of cleft palate, we must search for the exact mechanism induced by such surgery. Referring back to the phrase, "adequate, controllable velopharyngeal closure," we must inspect more closely the term "controllable." In many of our tests of closure we ignore one most important to normal speech and that is time. In normal speech the palatal movements are exceedingly rapid. Some scar, some loss of muscle fibers, some denervation must result from the most skillful closure. To expect normal amplitude of motion, in *normal time*, of such an organ is unreasonable. By decreasing the necessary amplitude and providing another fixed point, that is, the attachment of the soft palate to the posterior pharyngeal wall, the equation may be brought into balance. The importance of this fixed point is illustrated by the immediate depreciation in quality of speech in cases in which it is necessary for any reason to release the pharyngeal attachment. Such examples have been reported by Padgett,[1] Robinson,[5] Moran[2] and others.

The ten cases used as a basis of this report were selected rather strictly. The consistently good results obtained indicate for me the application of the method to a wider field.

CONCLUSION

The pharyngeal flap operation has been used by an increasingly large number of surgeons in the treatment of cleft palate.

Experience with ten operations is reported, with no technical operative difficulty and no postoperative complications. Definite improvement in speech was obtained in all cases. The factor of time in the equation of palatal movement is suggested as worthy of further study.

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EVALUATION OF CLEFT PALATE SURGERY

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UNTIL recent years the principal objectives of cleft palate surgery and follow-up care were (1) to effect a closure of the palatal cleft and produce a functional velopharyngeal sphincter, and (2) to improve the speech.

However, although these are certainly exceedingly important aims, considerable attention has been focused in recent years on a third objective, that is, to accomplish the first two objectives without permanent damage to the growth centers of the maxilla with the concomitant results of severe malocclusions, retrusions of the upper lip and the external "dish-face" appearance.

Many investigators have reported that they have been greatly disillusioned by the frequency of these late results seen in follow-up of cases done by the more commonly used methods. On the other hand, a great number of surgeons believe that many of these poor results would have occurred without surgery, and that properly performed surgery utilizing the more standard methods would not give such disappointing results.

The discussion in this paper will therefore be divided into two parts: (1) a brief review of the work regarding maxillary growth and some recent work on variations in the nasopharynx, and (2) a discussion of some of the methods of uranoplasty advocated to lessen this danger of maxillary growth inhibition.

Information concerning craniofacial growth has been gained by several methods, namely, by the study of dried skulls by anthropologists, by animal injection with alizarian red, a dye which stains bone in the process of formation, and by serial cephalometric roentgenography. This technic was introduced by Broadbent[1] in 1931. Two x-ray tubes are mounted at 60 inches from the mid-sagittal and porionic planes for lateral and frontal head plates. The patient is rigidly oriented by means of calibrated ear rods firmly inserted into each external auditory meatus.

The lateral cephalometric x-ray shows the salient points of the skull and facial bones in their true relationship. Tracings taken from these films can be analyzed, helping the investigator to determine the points of growth, and they can be compared with later tracings to measure changes in profile from surgery or growth accurately. Since hundreds of these have been exhaustively studied, variations from the normal growth pattern can be detected by one qualified in their interpretation.

The most important sites of growth of the maxillary complex are well shown in Waldron's[2] paper, in turn taken from Salzmann's[3] book on orthodontics. They are the frontomaxillary, zygomaticotemporal, pterygomaxillary and zygomaticofrontal suture lines.

It is important to remember that there is progressive downward and forward development of the facial bones along straight and parallel lines.

The anteroposterior growth of the maxilla results from: (1) growth of the tuberosity which is braced against the pterygoid process of the sphenoid causing the maxilla to move forward; and (2) there is also anteroposterior growth along the maxillary side of the transverse palatine suture between the horizontal plate of the maxilla and the palatine bone, and along the posterior margin of the palatine bone. The anteroposterior diameter of the bony palate more than doubles during the growth period, whereas the transverse growth is much less.

Transverse growth occurs in the median palatine suture and is affected by the downward and divergent growth of the pterygoid processes. Five-sixths of the complete growth occurs by the end of the fifth year, and all of it by the tenth year. This is an important point in later discussion.

Vertical growth is caused by bony deposition on the maxillary side of the zygomaticomaxillary and frontomaxillary sutures. This tends to push the maxilla downward and forward. There is also very active growth of the alveolar process in order to accommodate the development and migration of the teeth.

Mandibular growth occurs along the alveolar and free borders, and in the very important growth center in the condyles which lowers the mandible out of the way of the downward-developing maxilla.

The discussion to this point has concerned normal growth in normal individuals. Regarding maxillary growth in children with unoperated cleft palates, Peyton[4] found no significant difference in the first year of life between normal infants and those with unoperated clefts. Leven[5] found the same to be true with infants in the second year of life. However, he noted a significant lag in maxillary growth after a von Langenbeck repair.

Waldron[2] states that further studies at the School of Dentistry at the University of Minnesota showed moderate or extreme maldevelopment of the upper jaw, and consequent marked malocclusions were found all too frequently after the lip repair in infancy and the subsequent conventional palate repair at the age of eighteen to twenty-four months. In his opinion, the lag in normal growth was so obvious that there was no question that surgical repair interfered with the processes of growth. This, in essence, is also the opinion of Ivy,[6] Graber,[7] Slaughter and Brodie,[8] Dunn,[9] Hyslop and Wynn,[10] and others.

We have all seen cases such as are well illustrated in Graber's paper. These patients exhibit the "dish-face" profile, the small underdeveloped maxilla and the severe malocclusions. Their cephalometric studies reveal a definite negative angle of convexity, consistent with inadequate forward growth of the maxilla, and the wide intermaxillary clearance indicative of deficient downward growth of the maxilla.

Another growth and development variable that has only recently received much attention is that of the nasopharynx. Ricketts[11] has given me permission to draw on his yet unpublished diagrams and data. His work to date has been mainly concerned with development of a method of measuring the quantitative differences in the cranial base and the nasopharynx. It may be that such studies will help us to understand why some cleft palate patients with equally good repairs have different speech results.

Using mid-sagittal laminagrams, Ricketts measured the anteroposterior and vertical dimensions of the nasopharynx, the amount of obliteration of the bony space by soft, mostly adenoid, tissue, length and thickness of the soft palate, angle between the hard and soft palate, and position of the atlas above or below a line drawn through the nasal spines. He also believes that the angle formed between a line drawn from the posterior to the anterior margins of the foramen magnum and thence to the center of the sella turcica is of considerable importance in evaluation of these measurements. He has several cases which suggest that marked variation from the tentative "normal" size and shape of the nasopharynx may well help explain the presence of nasal speech in patients without cleft palates, as well as in postoperative cleft palates with good repairs. Again it should be emphasized that this is only a preliminary study and Ricketts has made no attempt to draw any conclusions from the cases so far studied. However, the possibilities to be explored along these lines are most interesting.

The discussion thus far brings to mind a question that will be considered in the second portion of this paper, that is, just what can be done to satisfy all three objectives in cleft palate surgery. How can the chances be improved of obtaining good closure, sphincter and speech, *and* a well developed maxilla with good, or at least better, occlusion? What are the practical applications of the studies just discussed?

Many investigators believe that any surgery which involves elevation of the mucoperiosteum of the palate will interfere with maxillary growth due to interference with the blood supply and actual physical restriction of growth by scar tissue. In general, they believe that there is a direct correlation between growth inhibition and the number of procedures.

It is argued that even though the palate is successfully closed, the patient requires prolonged costly orthodontia to try to correct some of the results of maxillary underdevelopment.

Because of this they advise against *any* mucoperiosteal elevation procedure until the end of the fourth or fifth year, when five-sixths of the transverse width of the palate have been achieved.

These concepts would appear to rule out the use of the von Langenbeck, Axhausen and Veau procedures in which mucoperiosteal flaps are elevated. Likewise, it would seem that the Dorrance "push-back" and the Wardill V-Y

procedures would come under this category. However, Kilner[12] states that the V-Y in his hands and those of his associates has not given the poor end results we have mentioned.

An interesting sidelight to the procedures just mentioned is the recent work of Broomhead[13] on the nerve supply of the palate. He states that separation of the tensor palati from the internal pterygoid muscle as done particularly in the V-Y procedure may result in damage to the tiny nerve which runs in this plane to the tensor. If section of the lesser palatine nerves takes place as they emerge from the lesser palatine foramina, there may be anesthesia of the soft palate and atrophy of the mucous glands which comprise at least one-half of the soft palate, with consequent diminution in the size of the soft palate. Last but not least, there may be paralysis of the uvula.

If, then, early use of these primary procedures may result in deficient maxillary growth and possibly in irreparable nerve damage, what alternative is there to their use?

The most commonly used alternative method is some modification of the Veau vomer flap procedure described in 1931.[14] In this, a vomer flap is sutured to a mucosal flap from the opposite side and a posteriorly based mucoperiosteal flap from the short side is swung over to cover part of the vomer flap.

Ivy[6] has used this method to close the anterior hard palate since October, 1931. He later closes the rest of the palate with the Axhausen modification of the von Langenbeck procedure.

Waldron[2] has obtained most encouraging results elevating but very little mucoperiosteum. He has followed up a series of cases for fifteen years and has found normal maxillary growth. He repairs the hard palate "as soon as the pediatrician feels the baby is ready for surgery."

In his cases a vomer flap is turned over and sutured under a small mucoperiosteal flap on the palate. It is important to make this incision at the line of demarcation between vomerine and palatal mucoperiosteum. Occasionally the flap is too inadequate and it is replaced; the lip is closed and the flap will usually reach in three to six months. The lip is repaired two weeks later and the soft palate at two years or later.

At this time an incision is made on the palatal side of the deciduous second molar, preserving 7 to 9 mm. height of gingival tissue. It is then curved just distal to the tuberosity to avoid the first permanent molar tooth germ and then along the raphe. The hamulus is fractured and the palatal muscles and superior constrictor are separated from the internal pterygoid. The soft palate is then closed with the minimum elevation of mucoperiosteum. If the palate is still too short, a two-flap "push-back" procedure is deferred until the child is seven to eight years of age.

Thus Waldron advocates closure of the hard palate at about four weeks, the lip two weeks later, the soft palate at two years, and the "push-back" at seven to eight years.

Dunn[9] reported that in 1946 he reviewed palate cases treated during twenty years prior to that date with the von Langenbeck technic, and found many discouraging results due to deficient maxillary development. He has therefore adopted a technic somewhat similar to that just discussed, depending on the position of the vomer—attached to one side of the cleft, not attached but protruding into the oral cavity and unattached but well within the nasal cavity.

In the first position the vomer flap is sutured under the palatal edge at two or more years of age. In the second, this same procedure is done bilaterally. In the third, two inferiorly based vomer flaps are used separately at six-month intervals.

Dunn closes the soft palate a little differently, in two stages. He first closes as much of the soft palate as possible without undermining, and at a later date closes the small residual fistula by means of two small flaps.

He states that he has obtained good results from the standpoint of palatal closure and avoidance of interference with maxillary growth. His patients have required no more orthodontia than non-cleft patients.

Havens[15] combines a vomer flap with a Wardill procedure at a later date.

Another approach to the problem of avoidance of mucoperiosteal elevation is advocated by Hyslop and Wynn.[10] This is the bone flap technic used by Brown[16] since 1925. It is a modification of the Dieffenbach-Warren operation.

Since Brown believed that the palate should be closed before bad speech habits were acquired, this procedure was and is done at nine to twenty-four months.

Bilateral bone flaps are developed, forced to the midline and approximated. Packs impregnated with furacin® are placed in the lateral incision. It is claimed that the operation does not interfere with normal maxillary growth due to mucoperiosteal elevation, and that good occlusion and speech results are obtained. Also, there is no severing of muscle attachments, nerve or blood supply.

SUMMARY

Serial cephalometric studies have helped determine more or less normal patterns of growth for the bones of the face and skull.

Similar studies on unoperated cleft palate cases through the second year of life show no significant difference from the normal pattern.

A number of investigators strongly believe that the commonly used mucoperiosteal-elevating procedures result in deficient maxillary growth, severe malocclusions and the so-called "dish-face," all due to interference with maxillary bone blood supply and the production of scar tissue on the maxilla. Some believe that if such procedures are contemplated they should be deferred until the end of the fifth year of life.

Variations in the size and shape of the cranial base and nasopharynx may have a decided effect on speech results obtainable by closure of a cleft palate.

The various Veau vomer flap and bone flap technics have been advocated by a number of surgeons to minimize poor end results.

It is still the opinion of many that a properly performed one- or two-stage palate closure will not cause any more maxillary growth disturbance than one would find in an unoperated group of cleft palate cases.

It is hoped that the many thorough quantitative and more objective studies now in progress will eventually give the best solution to the many problems so frequently faced in this type of case.

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Original Articles

SYMPATHECTOMY IN CHRONIC OCCLUSIVE ARTERIAL DISEASE*

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THE treatment of peripheral vascular sclerosis by lumbar sympathectomy has received definite impetus in the last five years. Scattered reports first appeared in surgical writings about 1935; however, these were mainly concerned with patients with advanced disease and the purpose of the operation was to promote healing of an amputation stump or to arrest progressive tissue necrosis. Recently many surgeons, including DeBakey,[1] Crane and Edwards,[2] Schumacher[3] and Madden,[4] have emphasized the value of earlier operation for these patients before tissue death of any great extent occurred, either to prolong the usefulness of the limb or in the treatment of intermittent claudication *per se*.

FIG. 1. Femoral arteriogram. A tortuous, poorly filled artery is outlined by the diodrast. The profunda branch is patent and numerous collaterals are demonstrated. Lumbar sympathectomy relieved this patient's claudication.

In the Peripheral Vascular Clinic of St. Luke's Hospital thirty-two patients with various stages of peripheral arteriosclerosis, treated by lumbar sympathectomy in the five-year period from January, 1947, to December, 1951, have been studied with two objectives:

An attempt was made to correlate the clinical and laboratory criteria normally used to appraise these patients with their subsequent response to sympathectomy. An effort was made to determine at what stage of the disease the best results could be expected from operation.

In reference to the first point, the usual clinical and laboratory tests are listed, with a brief résumé as to the relative importance of each in evaluating these patients for surgery.

Age, Sex and Duration of Symptoms. All played a minor role, if any, in the selection of individuals for surgery. The percentage of poor results fell in the age group over sixty-five, but in this group the presence of gangrene at the time of operation often precluded a high percentage of beneficial results. However, if some evidence of residual vasomotor tone could be shown, as occurred in two patients in the series (aged sixty-nine and seventy-one), operation achieved better results than in the

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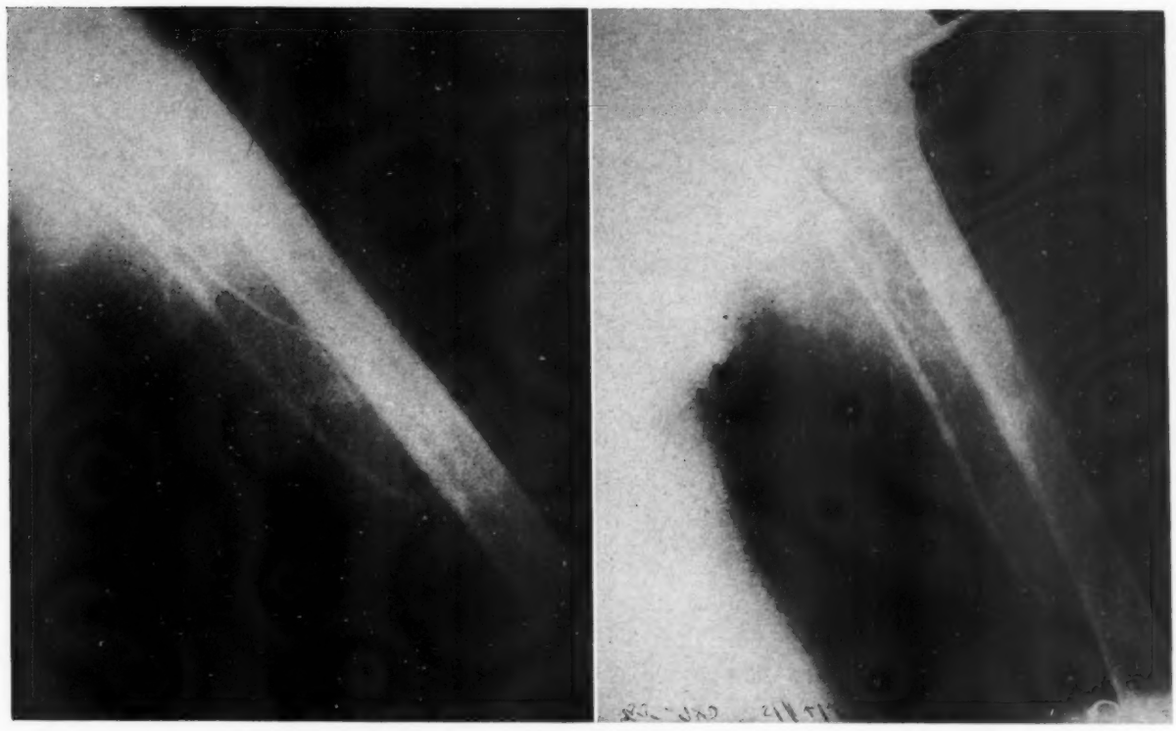

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FIG. 2. Arteriogram shows complete block of femoral artery. The profunda branch fills but there are few collaterals. The degree of claudication was markedly lessened by sympathectomy.

FIG. 3. Arteriogram shows tortuosity and abrupt occlusion of the femoral artery. Collaterals are minimal. A deep ulcer was present on the foot. No improvement occurred following sympathectomy.

forty year olds where little vasoconstriction could be demonstrated prior to operation. Response to sympathectomy was usually better in the patient with a relatively long history of circulatory complaints, probably because of the stimulation of the collateral bed in these individuals.

Diabetes. Although most authors have agreed that the presence of diabetes diminishes the likelihood of a favorable outcome in peripheral vascular sclerosis, the findings in this series have been somewhat to the contrary. There were eleven diabetics in the thirty-two patients studied, which is about the usual percentage reported in other series. Six of the eleven had very good results following operation. The remaining five, who had little or no palliation, were in the group with advanced tissue necrosis already present. In patients who complained only of claudication, continued cold feet or minor skin changes, no line could be drawn between diabetics and non-diabetics as to prognosis following surgery.

Peripheral Pulses. Absence of arterial pulsation from the popliteal level down could not be used as a criterion of the patient's response to surgical treatment. It was noted that the patients who had palpable pedal pulses at the time of operation uniformly obtained good results from sympathectomy, but even in the absence of pulsation a good clinical response was frequently obtained. Twenty-eight patients of the thirty-two had absent pulsation at the popliteal level, yet approximately two-thirds had good palliation from surgical intervention. In no instance, however, did pulsation which had been absent prior to operation return after operation.

Oscillometrics. The oscillometer was used on all patients in this series, both pre- and post-operatively. Its main use was in detecting pulsations not perceptible to the examining finger, thus more accurately localizing the level of the block in the main artery. Since little change was noted in the oscillometric readings following oral vasodilators, paravertebral block or sympathectomy, the instrument did not aid in evaluating candidates for surgery or in measuring its results quantitatively.

Vasodilator Drugs. All patients operated

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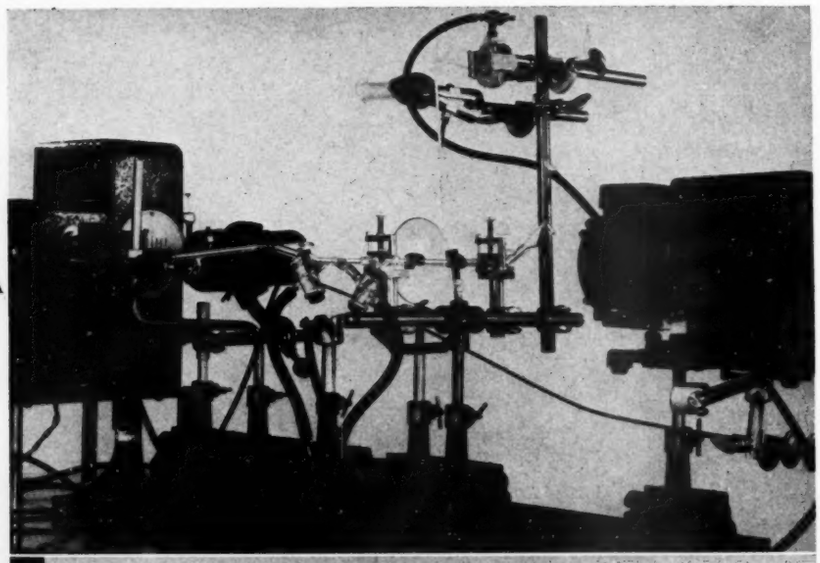

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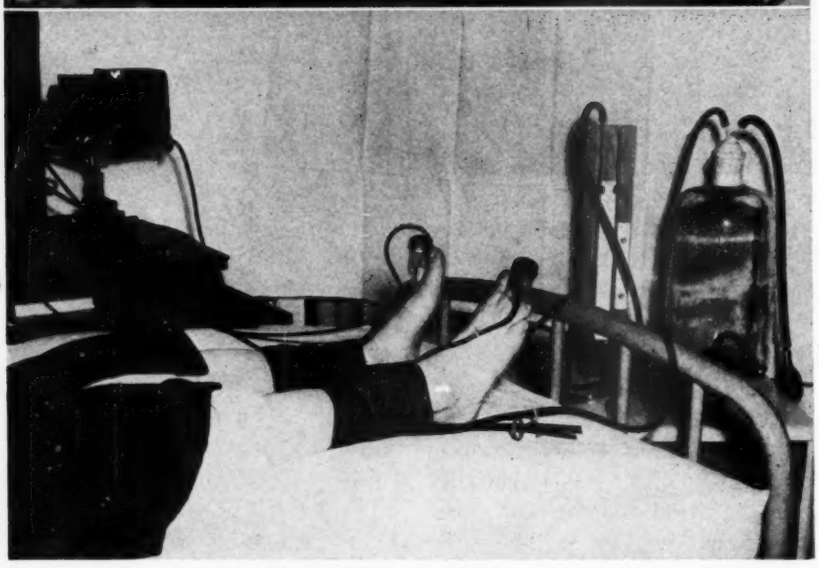

FIG. 4. A, the venous occlusion plethysmograph used in the current study. The light source is at the right of the reader. The volumetric pipettes attached to the patient's toes are shown in the center and the recorder is shown at the left. Changes in pulse volume and blood volume in the digit moves the meniscus in the pipette and the subsequent tracing is recorded at the left. B, a view of the patient with the air-sealed cups in place over the digits and tubes leading to the pipettes shown in the preceding view. A venous occlusion apparatus is shown on the reader's right.

upon had at least three months of medical evaluation prior to operation. This included therapy by one or more of the oral chemical vasodilators, namely priscoline,® roniacol and occasionally regitine. About one-half of the patients following this form of treatment had some subjective relief and a few also showed slight objective improvement as manifested by increased local temperature and better color and texture of the skin. All patients who reacted well to the drugs had beneficial results following sympathectomy. However, of the entire group of patients having a successful result following surgery, approximately one-half had little benefit preoperatively from the use of vasodilators. Therefore, a poor response to therapy with oral vasodilators did not preclude good results from sympathectomy.

Paravertebral Procaine Block, Spinal Anesthesia. Paravertebral block or spinal anesthesia was employed only rarely. The tests were found difficult to standardize, were time-consuming and not without complications. Furthermore, as had been noted by many observers, including Evans,[5] Schumacher[3] and Coller,[6] there was a distinct lack of correlation between the effect of an adequate procaine block and the actual long-range effect from sympathectomy. The changes following intramuscular priscoline and paravertebral block were compared on the plethysmograph, and it was found that the changes in blood flow and pulse volume were sufficiently alike to warrant use of the simpler, more rapidly acting priscoline.

Arteriography. Diodrast arteriography, like many of the criteria previously listed, is of value in some cases but proves of little aid in the borderline cases with minimal vasomotor tone present. Seventeen of the thirty-two patients had femoral arteriograms performed. In six of the seventeen patency of the main arteries or adequate collaterals were demonstrated. (Fig. 1.) All of this group had satisfactory results from sympathectomy.

The remaining eleven patients showed complete occlusion at varying levels in the femoral artery. In seven the symptoms were those of severe claudication and all had good results from sympathectomy (Fig. 2) with one exception. This was a forty-three year old man with only a six-week history of claudication prior to admission. Complete block was demonstrated by diodrast studies in the middle third of the right femoral artery. No evidence of necrosis was present in the foot but the patient failed to improve following removal of the left lumbar sympathetic chain including L2 and L3 ganglia. He required a mid-thigh amputation approximately five months post sympathectomy. The remaining four patients, all of whom had deep tissue necrosis at the time of operation, showed no improvement following sympathectomy and subsequently underwent thigh amputation. (Fig. 3.)

Tentative conclusions, therefore, drawn from this limited experience with arteriography are: (1) In patients with unobstructed femoral and popliteal arteries or with adequate collaterals a good response to sympathectomy may be anticipated. (2) In patients with occlusion of the femoral artery and with claudication as their only symptom good results may likewise be expected. (3) In patients with occlusion of the femoral artery and with tissue necrosis already present the results of sympathectomy are disappointing. (4) It appears to make little difference whether the occlusion occurs proximal or distal to the origin of the profunda branch.

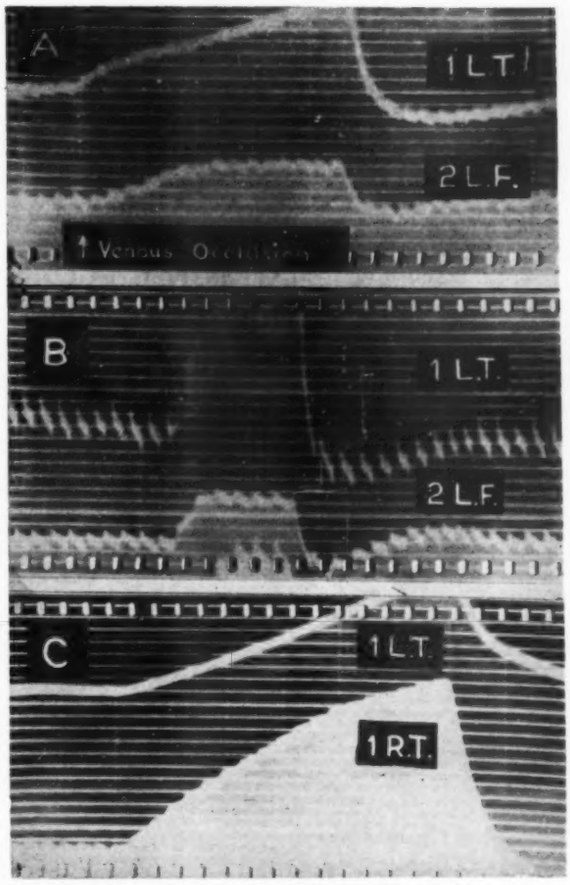

FIG. 5. Representative plethysmograms. Venous occlusion at arrow. Ordinates are volume (0.01 cc. vertical) and time (3 seconds, horizontal). Slope of curve illustrates change in digital volume or blood flow. Pulse volume is measured directly on the tracing. A, normal subject at rest; left toe and left second finger measured. B, same subject ten minutes after intramuscular injection of 50 mg. priscoline. C, patient with occlusive arterial disease. Note lack of pulsation in left first toe and slow change in digital volume (slope of curve) following venous occlusion. (From VAN ITALLIE, T. B. and CLARK, C. W., JR. The effect of priscoline on peripheral blood flow in normal subjects and patients with peripheral vascular disorders. *Circulation*, 3: 820–829, 1951.)

Plethysmography. Nineteen of the thirty-two patients were subjected to studies with the venous occlusion plethysmograph. (Fig. 4A

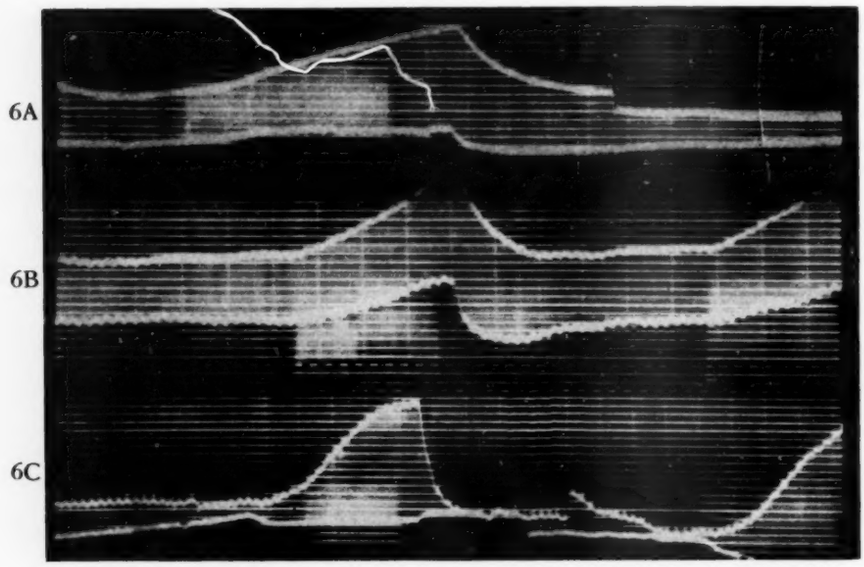

FIG. 6. Plethysmographic studies in arteriosclerotic peripheral vascular disease. A, resting state and following venous occlusion. Right first toe is top tracing. Left first toe is lower tracing. B, same patient after 50 mg. intramuscular priscoline. C, same patient two months after sympathectomy. Note comparative change in slope of curve and pulse volume.

and B.) Tracings were made before and after the intramuscular injection of 50 mg. of priscoline. Readings were recorded at ten-minute intervals for forty minutes after the administration of the vasodilator. (Fig. 5.)

Four of the nineteen patients tested showed absence of any pulse volume and no measurable change in venous filling following tourniquet occlusion either before or after priscoline. These four patients were not improved by sympathectomy. Five of the nineteen patients had a definite increase in the pulse volume and blood flow after priscoline; these five individuals had an excellent response both subjectively and objectively. (Fig. 6.) The remaining ten patients showed minimal vasodilatation with no change in the pulse volume, and only a small increase in blood flow subsequent to priscoline. Nine of the ten patients experienced definite improvement following operation. It is the authors' inclination at present to offer operation to all patients who show even a minimal response following the use of the vasodilator as determined by plethysmography.

In determining at what stage of the disease the best results could be expected from operation, as mentioned at the beginning of the paper, it became obvious during the study of this group of patients that they could be divided into three groups depending on the symptoms and the degree of local pathology.

In the first group all showed deep tissue necrosis. In the second group each patient complained of claudication plus a history of an acute arterial occlusion. In the third category the patients had intermittent claudication as their chief complaint.

There were eight patients in the series who fell into the first group and only one of these had any significant benefit from operation. Six of the seven failures required amputation, all within three months following operation. None of the latter were considered cases of "paradoxic gangrene" since the time interval was too long between operation and ablation of the limb. The one patient who did benefit was a sixty-five year old woman with advanced but asymptomatic arteriosclerosis, absent pulses by palpation and oscillometric studies, and reduced skin temperature. A deep ulcer had developed following cast application for a fractured ankle, and this had failed to heal following six months of conservative treatment. Subsequent to lumbar sympathectomy in January, 1947, the ulcer healed rapidly and has remained well to date.

In the group of patients with claudication plus a history of an acute arterial occlusion the benefit rate from sympathectomy was somewhat better. There were eight patients in this group, with five obtaining relief of symptoms and three in whom operation appeared to have

no benefit. All of the latter eventually succumbed to thigh amputation.

The results in the third group of patients, those with intermittent claudication as their only complaint, were the most gratifying. Of the total of sixteen cases in this category there were thirteen who benefited from operation. One of this group of thirteen was improved for about eighteen months following bilateral lumbar sympathectomy, then was readmitted because of a right femoral embolus. Despite intensive therapy including an operative right femoral arteriovenous shunt, right thigh amputation was necessary for progressive gangrene. The patient died subsequently of a myocardial infarct.

SUMMARY

1. A series of thirty-two patients with peripheral arteriosclerosis, treated by lumbar sympathectomy and followed up for a period of eighteen months to six years, is presented. There were no operative deaths.

2. Despite the use of a variety of diagnostic and prognostic tests, there was no infallible procedure or combination of procedures which accurately predicted the result of sympathectomy in these individuals. Arteriography and plethysmography were the most helpful.

3. Sympathectomy is of value in the majority of patients with symptomatic peripheral sclerosis, particularly in those individuals in whom tests indicate some residual vasomotor activity.

4. The poor results in patients with tissue necrosis have been emphasized not to condemn the operation in this group but to urge earlier intervention, particularly in patients with claudication as their main complaint, since it is in this group that the best results were obtained in our series.

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ARTERIAL EMBOLECTOMY*

REPORT OF SUCCESSFUL AORTIC, FEMORAL AND POPLITEAL EMBOLECTOMIES

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THE sudden embolic occlusion of the aorta or a major peripheral artery is a dramatic event that requires early recognition and treatment if loss of life or extremity is to be avoided.

Since the first attempt at removal of an arterial embolus by Ssabanejeff in 1895 and the first successful embolectomy by Labey in 1911, there have been growing reports of successful embolectomies.

The purpose of this article is to review briefly the current trends in treatment of arterial emboli and to report two case histories: (1) the removal of a saddle embolus of the aorta; (2) popliteal embolectomy twenty-four hours after occlusion of that vessel and a femoral embolectomy in the opposite extremity four days later. More detailed reports of historic and statistical significance may be found elsewhere in the literature.[1-3]

ETIOLOGY

The great majority of arterial emboli (80 per cent) originate in a diseased left side of the heart. Rheumatic and arteriosclerotic heart disease and the heart disease following coronary occlusion are the most common causes. A mural thrombus forms within the lumen of the heart and subsequently dislodges to become an embolus. The histories of these patients will usually reveal a recent change in the cardiac mechanism. A change in the rate and/or rhythm of the heart secondary to treatment with digitalis, especially its rapid administration or withdrawal, frequently initiates dislodgment of the embolus. Arterial emboli frequently are found in patients with auricular fibrillation.

Less common sources of the embolus may be: mural thrombus of the aorta, arterial aneurysm, pulmonary vein thrombosis and peripheral vein thrombosis associated with a cardiac septal defect (paradoxic embolus).

DIAGNOSIS

As mentioned previously arterial emboli most frequently occur in patients that are known to have heart disease and in whom treatment has just been instituted or changed, either voluntarily or at the physician's suggestion. Occasionally the patient will have a premonition of impending disaster. Numbness and tingling occurs almost immediately following lodgment of the embolus. Severe pain soon develops distal to the site of the occlusion; the extremity immediately has loss of distal pulsations; coolness and blanching closely follows; and cyanotic mottling may develop. Paralysis usually develops later as the ischemia increases, but may occur almost immediately if the reflex vasospasm is severe.

Peripheral arterial thrombosis usually has an insidious onset; but if marked reflex vasospasm accompanies the thrombus formation, the differential diagnosis may be difficult. The arteriospasm associated with severe thrombophlebitis will rarely cause a cold, pulseless extremity. The presence of edema and absence of paralysis in this condition are the differential diagnostic points.

The incidence of the site of embolic occlusion is given as follows:

SITE OF EMBOLUS	PER CENT
Femoral artery	55
Iliac artery	17
Brachial artery	12
Popliteal artery	11
Bifurcation of aorta	4-5

Because of the abrupt narrowing at the bifurcation of an artery most emboli lodge at this site. In these cases localization is rarely a problem. The level of demarcation in color and temperature of the extremity will, in most instances, localize the site of occlusion. Oscillometry and arteriography are rarely needed but may be used to advantage in some cases.

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TREATMENT

An embolus involving an artery of the upper extremity is best managed with conservative measures, i.e., vasodilators, anticoagulants and the like. If the embolus involves the aorta, iliac or femoral arteries, it should be treated as a surgical emergency. As the interval from onset to removal is increased, the chances of a successful outcome are decreased; consequently all medical treatment is directed toward early removal of the embolus. Patients in whom a popliteal embolus develops should be individualized and treatment dictated by the findings in each case. Some can be satisfactorily managed with conservative measures, others will require prompt surgical removal of the embolus.

Marked vasospasm distal to the embolus slows the circulation and enhances the formation and propagation of a thrombus. Prevention of such thrombus formation not only before but also for a considerable time after embolectomy is of paramount importance. If for any reason a delay is necessary before surgery, a lumbar sympathetic block with procaine hydrochloride should be done. Some[2] believe this procedure is contraindicated because it may allow the embolus to pass to a more distal artery that is less available. It seems paradoxic that the opponents of the use of sympathetic block advocate the use of systemic antispasmodics (i.e., papaverine) that is less efficacious in overcoming arteriospasm. Mechanical dilatation with intermittent suction and pressure (pavex) may be used after, but in my opinion should not be used before embolectomy.

The immediate use of heparin and dicumarol will have no effect upon the embolus but will help prevent formation and propagation of an associated thrombus. The use of dicumarol postoperatively may be continued indefinitely. The patients in both cases reported herein have been taking dicumarol since embolectomy without subsequent embolic phenomena (thirty-five months and eleven months).

Extremes of temperature should be avoided; cold increases vasospasm and heat increases metabolism in an extremity with pre-existing embarrassment of the circulation. Elevation of the affected extremity is likewise contraindicated. Dependency is harmful. Occasionally the sitting position will be assumed due to the cardiac status of the patient.

The type of anesthetic agent used is not as important as the ability of the anesthetist. Unless there is wide deviation from a normal blood pressure, spinal anesthesia with procaine hydrochloride is the method of choice.

The services of a competent internist to treat the cardiac abnormality both pre- and postoperative is infrequently mentioned, but is of the utmost importance.

CASE REPORTS

Case 1. Mrs. C. B., age forty-two, was admitted to the Medical Service of the Chesapeake and Ohio Hospital at 12:45 A.M. on January 24, 1952. Her complaint upon admission was pain in both legs. At 9:00 P.M. on January 23 (about four hours prior to hospitalization) while sitting at her dressing table sudden, generalized weakness and a tingling sensation in both lower extremities developed. Numbness occurred in both legs almost immediately and the patient was unable to move them. Shortly thereafter bilateral lower leg pain developed which was most marked in the left leg. The patient was seen by her local physician, who administered a hypodermic of morphine and advised immediate hospitalization.

The patient's past history revealed known rheumatic heart disease since 1937. She had been examined in this hospital in February, 1951, and upon discharge was instructed to take purodigin, 0.1 mg., daily. She had discontinued the use of this drug two weeks prior to the development of the aortic embolus.

Examination upon admission revealed a female of the approximate stated age, who was in acute distress, complaining bitterly of bilateral leg pain. The blood pressure was 125/85 and pulse 120. Auricular fibrillation was present. There was a generalized pallor with mild lip cyanosis. Coarse rales were heard at both lung bases. From the distal thighs to the toes the legs were white. There was a progressive coolness from the lower abdomen, distally. The feet were cold. The veins were collapsed. Aortic pulsation was present above the level of the umbilicus. No pulsations were present in the femoral, popliteal, dorsalis pedis or posttibial arteries of either lower extremity.

The patient was given dialudid, gr. 1/32, depo-heparin 200 mg. and crystodigin 0.4 mg. Nasal oxygen was instituted.

Surgical consultation was requested and after examination aortic embolectomy was advised.

The patient was cross-matched and typed for 3 pints of whole blood. Surgery was started at 4:10 A.M., about seven hours from the onset of the embolus. A spinal anesthetic (pontocaine, 20 mg.) was administered. A right, muscle-splitting, para-umbilical incision was made and the abdomen entered. The intestines were retracted. The posterior parietal peritoneum overlying the great vessels was opened longitudinally. The iliac arteries were partially mobilized and surrounded by cotton tape near the bifurcation of the aorta. A cotton tape was placed around the aorta proximal to the embolus. A rubber-shod clamp was held in place by the first assistant in order to compress the aorta proximal to the occlusion, if that became necessary. A longitudinal incision was made in the aorta, overlying the embolus. The embolus was removed and, upon release of the tourniquet proximally, there was a profuse gush of bright red blood. Both iliac arteries were patent. The incision in the aorta was closed with interrupted No. ooooo silk sutures. Upon release of the proximal tourniquet common iliac artery pulsations were present and there was no evidence of leakage at the site of the incision. The parietal peritoneum was closed with atraumatic catgut sutures. The abdomen was closed in layers. During the operative procedure the patient received 1,500 cc. of whole blood. Her blood pressure remained low throughout most of the operative procedure and at the completion of surgery was 60/40. Femoral pulsations were present immediately after surgery. The legs had a mottled appearance.

Upon return to her room the patient was placed in an oxygen tent; fibrillation continued. The patient's condition remained critical for twenty-four to forty-eight hours following surgery. Shortness of breath and cyanosis were marked six hours after surgery. I am confident that the internist's judicious use of intravenous quabain for rapid digitalization at this time saved this patient's life.

Twenty-four hours after surgery there were good pulsations in the femoral and popliteal arteries, bilaterally, and faint pulsation in the left dorsalis pedis. There was coolness and pallor of both feet, but the veins were no longer collapsed. Numbness of the toes was present for several days following surgery. Depo-heparin sodium, 200 mg., was administered daily for the first three postoperative days, by which time dicumarol had become effective. The patient could not be ambulated until the eighth postoperative day because of her cardiac condition. At the time of discharge, on the twenty-first postoperative day, she could walk around the room. Pulsations were present in both dorsalis pedis arteries. Dicumarol therapy has been continued since surgery by the internist. Ten months after surgery the patient is doing light house work. She still has some discomfort in her left leg with a burning sensation of the skin overlying the tibia. She rests about two hours during the day and ten hours at night. Her blood pressure is 120/80. Lip cyanosis is present. She is taking digitalis regularly and 50 mg. of dicumarol every other day has maintained her prothrombin time between 25 to 35 per cent of normal.

CASE II. R. C., a sixty year old white man, was admitted to Saint Mary's Hospital on January 6, 1950 at 5:30 P.M. He gave a history of having had a sudden onset of severe pain in the left thigh at 8:30 P.M. on January 5, 1950, while preparing for bed. He stated that his foot and toes became paralyzed almost immediately. The pain was severe and "knife-like," requiring a hypodermic by his local physician. This pain persisted throughout the night. The next morning he was referred to this city, arriving by ambulance at 5:30 P.M. on January 6, 1950.

The patient had had heart trouble for several years for which he had taken digitalis at intervals. He had been taking this drug sporadically for three or four weeks prior to the development of the popliteal embolus. He had an episode of severe chest pain about one month prior to admission. One can only speculate as to its having been an arterial embolus to the lung.

Examination upon admission revealed a male of the approximate stated age, lying quietly in bed, but complaining of agonizing pain in the left lower leg. The blood pressure was 165/85 and the pulse 100 per minute. The rhythm was irregular with a pulse deficit. There was a systolic and blowing diastolic murmur at the left sternal border. All pulsations were present in the right leg and there was a good femoral pulsation in the left leg. Popliteal, dorsalis pedis and posterior tibial pulsations were absent in the left leg. Mottling and cyanosis were present in a stocking distribution extending from 2 inches below the left patella, distally. The lower leg was distinctly colder than the thigh.

The patient was able to move the left leg and foot, but could barely move the toes. A lumbar sympathetic block, with procaine hydrochloride, was performed immediately. One hour later there was neither symptomatic nor objective improvement and a popliteal embolectomy was advised.

At 10:00 P.M., twenty-five hours after the embolus had lodged at the popliteal bifurcation, surgery was performed. Spinal anesthesia, utilizing 100 mg. of procaine hydrochloride, was administered. A longitudinal incision was made in the skin over the left popliteal space. By blunt dissection the popliteal artery was visualized and traced distally to its bifurcation. It was necessary to divide the heads of the gastrocnemius muscle and to divide the soleus muscle in the long direction of its fibers to locate the bifurcation of the popliteal artery. There was an excessive amount of tissue dissection which was undesirable and added to the reflex spasm that was already present. An embolus could not be palpated before the popliteal artery was opened. Arterial clamps were utilized to occlude the popliteal artery proximally and the anterior and posterior tibial arteries distally. A longitudinal incision was made in the popliteal artery and a soft clot was aspirated. A small catheter was inserted into the tibial arteries and no obstruction was present. The incision in the artery was approximated with interrupted No. ooooo atraumatic silk sutures. The subcutaneous tissues and skin were approximated and a dressing applied. At the completion of the operation the patient's leg showed no improvement and it was believed that an amputation would be necessary. Six hours after surgery the calf was warmer with less cyanosis and no mottling. The patient was digitalized; heparin and dicumarol were started and a series of sympathetic blocks begun.

Thirty-six hours following embolectomy the foot showed increasing warmth but the ankle and toes could not be manipulated by the patient. There was gradual improvement and on the eighth postoperative day posterior tibial pulsation was present. The involved extremity showed definite benefit after sympathetic blocks and, consequently, thirteen days after embolectomy a left lumbar sympathectomy was performed. Dicumarol had been discontinued two days prior to the lumbar sympathectomy. Four days after the sympathectomy (six days after dicumarol had been discontinued) sudden occlusion of the right femoral artery developed. An embolus was removed about four hours after onset.* Pulsations in the right leg returned immediately and the patient has had no symptoms or abnormal physical findings in the right leg since embolectomy. After the second embolectomy dicumarol was again started and has been continued until the present time.

Upon discharge from the hospital on February 8, 1950, thirty-two days after the left popliteal embolectomy, the patient had a left foot-drop, requiring a foot-drop shoe and leg brace. He voluntarily discontinued using this apparatus two to three months later and now walks without any noticeable physical abnormality.

The prothrombin concentration was obtained every two weeks for several months following discharge from the hospital and now is checked every three months. He is taking maintenance doses of digitalis under the supervision of an internist. He was examined on September 2, 1952, at which time there was peroneal nerve weakness without foot-drop. He could walk one or two blocks before discomfort developed in his left leg.

CONCLUSION

A brief discussion of the etiology, diagnosis and treatment of arterial embolism is presented. Successful aortic, popliteal and femoral embolectomies are reported.

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* The embolus was removed by Dr. Francis Scott.

VENOUS THROMBOSIS

THE PROBLEM AND ITS MANAGEMENT

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THE sharp decline in fatalities from shock, infection and hemorrhage due to appropriate remedial and prophylactic measures has been reflected in a proportionate increase in thromboembolic accidents. In a recent article Ochsner[53] presented statistics indicating an actual increase in the incidence of venous thrombosis despite unusual vigilance for its occurrence at Charity Hospital in New Orleans, and despite the thought, research and attention which the subject has received in the past decade. This increase may be partly attributed to our longer span of life and the increased scope of surgical procedures on older age groups despite any positive benefit from early postoperative ambulation or other prophylactic measures.

One is overwhelmed by the voluminous and unfortunately controversial literature on the subject indicative of the difficulty of management of such an obviously simple pathologic entity, which may and does strike all ages[39] although 80 or more per cent of cases are found in patients over forty years of age.[36,37,71] Venous thrombosis may be considered a minor pathologic process with major clinical consequences.[41,46]

There can never be a panacea for a condition whose first symptom or sign is sudden death. Fortunately, this fact is true only in a very small irreducible percentage of cases in which there is nothing in the clinical or laboratory picture prior to the fatal embolus to indicate the presence of intravascular clotting. Yet most peripheral vascular experts are in accord in claiming that careful daily observation and alertness for the presence of venous thrombosis will often reveal some significant symptom or sign to warrant appropriate and effective therapy.

More significant signs and symptoms are: (1) pain with or without tenderness over calf muscles, malleoli or plantar surfaces; (2) induration of deep calf veins (Neuhof); (3) pain in dorsiflexion of foot with leg extended (Homans); (4) swelling of leg; (5) unexplained rise in pulse or temperature; (6) pain in chest with or without cough or bloody expectoration; (7) apprehension, pallor, nervousness or a feeling of impending disaster; (8) temperature differences in the legs; (9) cyanosis of the legs; (10) dilated sentinel veins (Pratt); (11) diminution of intensity of femoral pulse (D'Alessandro). The finding of any one of these should warrant the immediate use of some form of therapy. Our observation of a diminished femoral pulsation may not be as prominent in very elderly patients with marked arteriosclerotic vessels incapable of the spasm reported.[20]

PATHOLOGIC PHYSIOLOGY OF VENOUS THROMBOSIS

Venous thrombosis is usually secondary to infection, trauma or physiologic disturbances in the normal coagulation mechanism. Factors are: (1) injury to intima of vein, (2) venous stasis and blood "sludging," (3) increased blood coagulability, (4) age, (5) immobilization, (6) obesity, (7) lowered metabolism, (8) chronic debilitating diseases (e.g., cancer), (9) anemias, (10) increased blood viscosity (e.g., dehydration and polycythemia), (11) systemic infections, (12) circulatory disturbances (especially in cardiac patients and those with varicose veins), (13) pregnancy, (14) trauma, (15) surgery (especially of abdomen and pelvis), (16) constitutional inferiority—"thrombophiles," (17) climate and atmospheric conditions (?), (18) tobacco, (19) antibiotics (?). The process of intravascular clotting has been clinically differentiated into the more silent, insidious and potentially more dangerous phlebothrombosis, in which the emphasis is on the thrombotic process, and the more obvious and symptomatic thrombophlebitis with its disabling postphlebitic syndrome.

It is very unlikely that such an active process as intravascular clotting with its foreign body reaction is ever purely the one or the other. The clinical differentiation is based solely on the degree and extent of inflammatory reaction in the venous segment involved. It is also inconceivable that we should ever be aware of the presence of "pure" phlebothromobsis in the absence of any phlebitis except by some delicate laboratory test not yet devised. The most recent antithrombin test of Kay and Ochsner has not stood the test of time and our personal experience with it in the past two years has been discouraging.[55] The same may be said of other laboratory procedures as being either too cumbersome or inaccurate, or both, to warrant their everyday use for the detection of "thrombophiles."

Venous thrombosis *per se* is never fatal nor necessarily disabling if limited to a fraction of the venous system of an extremity. How else could we justify such radical thrombosing procedures as inferior vena cava ligations? The entire problem therefore resolves itself into, first, the preservation of life and, secondly, the prevention of disabling sequelae.[41,54]

Our concept of venous thrombosis envisions it not as a static but rather as a progressive living process regardless of what initiating factors may have been involved. It is generally accepted that the intravascular thrombus is initiated by a collection of blood platelets at a microscopic or macroscopic site of injured intima of a vein in which the blood flow is reduced.[1,13,21,48,75] This fact explains why more than 90 per cent of venous thrombi arise in the veins of the foot or calf, especially in elderly patients confined to bed. Yet there is no disputing the fact that venous thrombosis may and does occur in ambulatory individuals with no apparent pathologic condition, trauma or disability. Within the past year we had occasion to see a patient who was robust, active and entirely free of complaints until one morning when he complained of severe anterior chest pain, dizziness, diaphoresis and the anxiety that goes with pulmonary embolism. There were three such attacks in a period of four days before it was noted that one leg was beginning to swell and the patient complained of some pain in the calf, thereby revealing a thromboembolic syndrome. These cases are by no means common, but they do occur often enough to make us aware of their possibility instead of assuming, as we might, that the chest pain is of coronary or upper abdominal origin.

This "platelet" thrombus is generally fixed to the vessel wall, however lightly, and remains as the head of the actual thrombus which is to follow, and which becomes known as the body and tail in that order. This process was excellently and vividly depicted in a microfilm taken by Best in the course of his studies with heparin.®[13] The body, which grows laterally as well as longitudinally from the head, is formed of fibrin and corpuscular elements of the blood and eventually fills the lumen of the vein so as to occlude it. This occlusion is further aided by the vasospasm that takes place in all the adjacent circulatory vessels.[40,56] As the occlusion of the lumen is accomplished, there is more or less "fixation" of that portion of the thrombus to the wall, the speed and degree of which fixation will vary with the inflammatory reaction aroused by the foreign body. This picture has been repeatedly recognized by us in the course of vein ligations and thrombectomies. We have been impressed on many occasions by the force with which a soft thrombus will "pop" out of a vein when it is incised, and the apparent stickiness of the thrombus as it is pulled out of the vein.

It is difficult for us to appreciate the embolic threat of such a clot as described previously, which is capable of withstanding the trauma and manipulation necessary for the isolation of the vein. We must therefore conclude that the great danger of embolism resides almost entirely in the thinner, more friable and unfixed tail of a thrombus, which grows longitudinally downstream before it grows laterally and which may be broken off or actually pull the entire loosely attached thrombus along with it in response to some external or internal force as was demonstrated by Valsalva.[15] The size of the body of a thrombus is inversely proportional to the size of this friable tail from which it grows as a continuous process inhibited only by anticoagulants or a rapid flow of blood such as may occur at the junction with a large collateral vein as depicted in Figure 1.[61]

It would seem logical that if this freely swinging, friable tail of a thrombus could be controlled or prevented from propagating, the danger of embolism would be eliminated with the simultaneous fixation of the coagulum to

the vessel wall by virtue of its foreign body reaction, eventual organization and not infrequent recanalization.

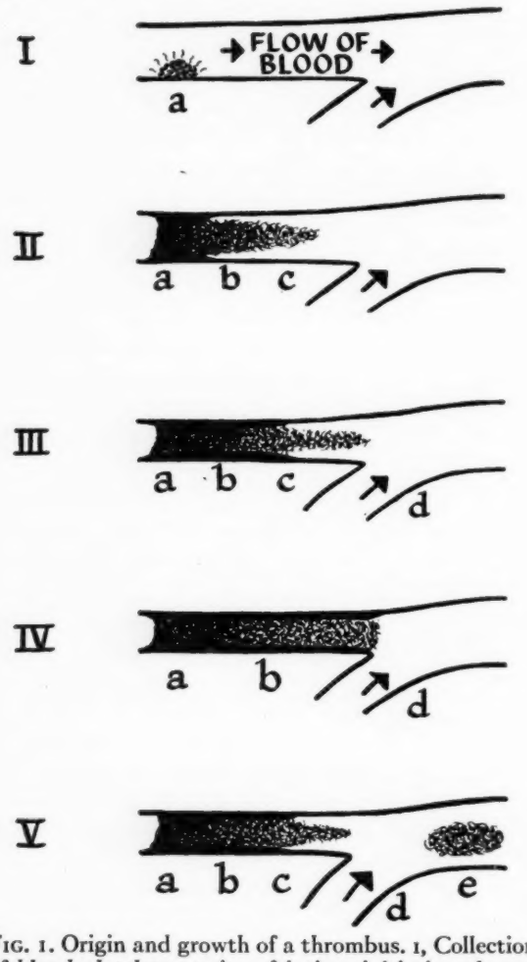

FIG. 1. Origin and growth of a thrombus. I, Collection of blood platelets at site of intima initiating thrombosis. II, Extension of platelet or white thrombus (*a*) and formation of red thrombus or coagulum (*b*) which grows in all directions. Red thrombus composed of fibrin and corpuscular elements of blood. III, Extension of red thrombus with beginning "fixation" of the more proximal part of the body (*b*). Growth of unattached tail (*c*) whose further growth may be limited by rapid flow of blood from vein (*d*). IV, The same thrombus as in III with further propagation inhibited by anticoagulants while foreign body reaction "fixes" it to vessel wall. V, The same thrombus as in III without anticoagulant therapy showing the loosening of an embolus (*e*).

TREATMENT OF THROMBOEMBOLISM

The greatest emphasis must always be placed on proper prophylactic measures for reducing the incidence of venous thrombosis. However, in spite of any and all efforts to the contrary, venous thrombosis will occur and must be vigorously treated.

It is on the basis of the foregoing concept of the pathologic physiology of venous thrombosis that we have found proper and adequate anticoagulant therapy as the treatment of choice, but not necessarily to the exclusion of other recommended procedures.[25,28,29,42–45,60,66] Experience has taught us that adequate treatment for a period of ten to fourteen days is usually sufficient to accomplish this fixation of a thrombus and thereby eliminate any threat of embolism therefrom. In addition, proper anticoagulant therapy will prevent the propagation of any pulmonary embolus with possible occlusion of additional arterial channels in the pulmonary circuit.

Having justified the rationale of anticoagulant therapy in the management of thromboembolism, we have but to choose the best available anticoagulant. At the beginning of the past decade we advocated the use of intravenous heparin as first proposed by Jorpes[32–34] and Murray.[18,50,51] Despite the expense and inconvenience of continuous intravenous heparin as first used, we believe that many lives were saved by this treatment. Subsequently, heparin was successfully mixed in slowly absorbing media and given subcutaneously once every twenty-four to forty-eight hours. We have found the best results from intermittent intravenous or subcutaneous injections every four to six hours.[16,27] By the subcutaneous administration of 50 to 75 mg. of concentrated heparin every four to six hours following an initial 100 mg. intravenous injection for prompt action, we have been able to maintain the coagulation time at 25 to 50 minutes in most instances. However, occasional coagulation times of one or more hours have never given us any cause for anxiety. Recently a sublingual form of heparin[42] was introduced. Personal experience with heparin linguets* in ten cases would indicate that this route of heparin administration is not feasible.

Early in the past decade 3,3′-methylene-bis-(4-hydroxy-coumarin), dicumarol,® was given an extended and fair trial in the management of venous thrombosis,[6] but we abandoned its use because of its apparent if not proven toxicity and its delayed, prolonged and unpredictable action in any one case.[63,69,74] The greater economy and cost of administration of dicumarol did not, in our opinion, offset its

* Heparin linguets of 100 mg. each supplied by Abbott Laboratories for investigational purposes.

objectionable and dangerous features.[8,10,26,38] More recently we have used 3,3'-carboxymethylene bis-(4-hydroxycoumarin) ethyl ester (tromexan®) which we have found superior to dicumarol in most respects save economy, but still retaining most of the objectional features even if to a lesser degree. The actual saving to the patient with dicumarol or tromexan therapy as compared to heparin therapy is more apparent than real in view of the necessity of the much more expensive, difficult and erratic prothrombin time test necessary in dicumarol therapy.[2]

We have had considerable experience with the surgically popular method of vein ligation, which has shed much light on our present concept of the pathologic process. Vein ligation, as proposed by Homans and popularized by Allen and his group in Boston, has been lifesaving in many cases. However, its indiscriminate or prophylactic use is unnecessary, unphysiologic, often aggravates the clinical picture and is by no means the simple, uncomplicated operative procedure that Allen would have us believe.[3–5,23] We are happy to see that vein ligations are not as popular now as a few years ago. While we have had sufficient experience with both femoral and inferior vena cava ligations, we have never been fully convinced that we were attacking the problem in the most rational manner. There is little doubt that it is a most expedient and reassuring procedure in some instances, but in many cases we spent anxious hours over the prospect of loosening an embolus in the course of our operative procedure or damaging the adjacent structures (artery, nerve and lymphatics), especially in the presence of marked inflammatory reaction. We must not lose sight of the fact that vein ligation gives us security only from that segment of the venous system ligated, while a thrombotic process may be taking place in an adjacent or some distant vein.[30,49,62] We, like others, have had patients shoot emboli following bilateral superficial femoral vein ligations, but can recall no case of embolization in the course of adequate heparinization. That emboli do occur in the course of heparinization is a known fact, but the incidence is no greater than that of emboli following ligation and the treatment is certainly much less radical.

Thus it becomes obvious that we favor heparin anticoagulant therapy as the treatment of choice in the management of thromboembolism and recommend that vein ligations be reserved only for those few cases in which anticoagulant therapy has apparently failed or is contraindicated. Heparin is the anticoagulant of choice because it is rational, physiologic, non-toxic, effective, quick-acting, easily controlled, may be used during menstruation or pregnancy, readily neutralized by infusion of whole blood or injection of protamine sulfate and has the least contraindications.[7] Heparin has the additional very significant advantage of inhibiting platelet agglutination even before any appreciable effect on the coagulation time.[70]

We do not, however, advocate indiscriminate prophylactic anticoagulant therapy because the treatment is by no means without danger; and as De Bakey and others have remarked, if one had to choose between bleeding to death or dying from a large pulmonary embolus, the latter has many advantages.[72]

Contraindications to heparin therapy are: purpura; blood dyscrasias with bleeding tendency; severe hypertension; following recent intracranial or intraspinal surgery; and absence of adequate laboratory and transfusion facilities.

Among other therapeutic measures of note, lumbar sympathetic blocks deserve some recommendation for the dramatic, symptomatic relief obtained.[40,52,58] This relief is, of course, in direct proportion to the degree of thrombophlebitis present and may actually be dangerous in some cases of phlebothrombosis from the standpoint of encouraging embolization as the result of vasodilatation. Lumbar sympathetic blocks should also be avoided in conjunction with anticoagulant therapy to avoid possible serious retroperitoneal hemorrhages.[56] When blocks are done, they should precede the anticoagulant therapy.

We also recommend the prophylactic use of the Sanders oscillating bed as being of distinct prophylactic value in overcoming venous stasis of the lower extremity and have used such a bed to advantage at our hospital during the past four years.[19,64] Antibiotics and supportive treatment with analgesics and elastic bandages are used as indicated.

SUMMARY

1. Venous thrombosis is an ever increasing and progressive pathologic process of intra-

vascular clotting which can best be managed by anticoagulant therapy.

2. Heparin is the anticoagulant of choice for reasons outlined.

3. Vein ligations are neither physiologic nor more efficacious than anticoagulant therapy in the management of thromboembolism, and in necessitating another surgical procedure they often aggravate the pathologic condition.

4. In the absence of an unforseeable panacea for the detection and treatment of the "thrombophiles" there will always be an irreducible minimum of thromboembolic deaths.

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FATAL REACTION FOLLOWING INTRAVENOUS 10 PER CENT DEXTROSE*

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PRESENTED herein is a case of an eighteen year old patient who died after receiving 10 per cent dextrose in water intravenously. No similar case has been previously reported in the literature as far as could be found (1924 to 1950).

CASE REPORT

An eighteen year old female was admitted to the hospital with the complaint of abdominal pain for two days and no bowel movements for one week. The past history revealed incapacitating asthmatic attacks for the previous four summers. Abdominal and rectal findings on admission were minimal in contrast to the history. Laboratory findings were not abnormal. On the fourth day, because of the continued pain, the patient had an abdominal exploration and appendectomy without incident.

On the afternoon of the day of operation, the patient was receiving 2,000 cc. of fluid intravenously. The second 1,000 cc. of 10% dextrose had just been added when she developed a chill. Her temperature rose immediately to 106°F., with a blood pressure of 60/0. The remaining portion of the intravenous fluid was removed and in view of the chill was sent to the laboratory for examination. The lungs at this time showed good breath sounds throughout but scattered rales were noted at both bases consistent with spotty atelectasis. The patient subsequently coughed up mucous plugs. Her temperature dropped within several hours. The patient was given 1,000 cc. of ⅙ molar lactate to alkalinize the urine. Blood pressure taken by the examiner was 100 systolic without detectable diastolic sound change. The patient seemed to be recovering from whatever type of attack she had at this time.

Approximately six hours later the patient again began to have an elevation of temperature, pulse and respirations, with a drop in blood pressure to 60/20. The trachea was aspirated at that time and a large amount of mucus was removed. During this period the patient became somewhat cyanotic and nasal oxygen was administered. Because the patient's blood pressure remained down, she was treated with shock blocks, neo-synephrine, plasma and adrenal cortical extract. Because of her asthmatic history benedryl and ephedrine were tried without relief of the cyanosis. The lungs at this time were clear, the abdomen was soft, the incision clean and the rectum showed no abnormality. A few insignificant petechiae were noted under the blood pressure cuff.

During the first postoperative day the patient remained in shock at blood pressure levels of 50–60/30–40. She received large quantities of adrenal cortical extract, blood transfusions and other fluids. Cyanosis persisted in spite of continuous nasal oxygen and during the afternoon the lungs became dull with moisture at both bases. However, a portable chest x-ray in the early afternoon failed to show definite consolidation. The temperature remained at 103°F., with corresponding elevation of pulse and respirations. Because of the persistent cyanosis methemoglobinemia was considered and methylene blue given intravenously but without effect. After a blood culture was obtained, the patient was placed on large doses of penicillin and streptomycin.

A medical consultant made a diagnosis of probable streptococcal septicemia with acute adrenal insufficiency, and bilateral bronchopneumonia.

On the second postoperative day the patient's pressure rose to 120/90. A CO_2 combining power of 18 volumes per cent mounted to 38 volumes per cent on intravenous sodium lactate. A non-protein nitrogen of 80 dropped to 70. An unsuccessful effort was made to

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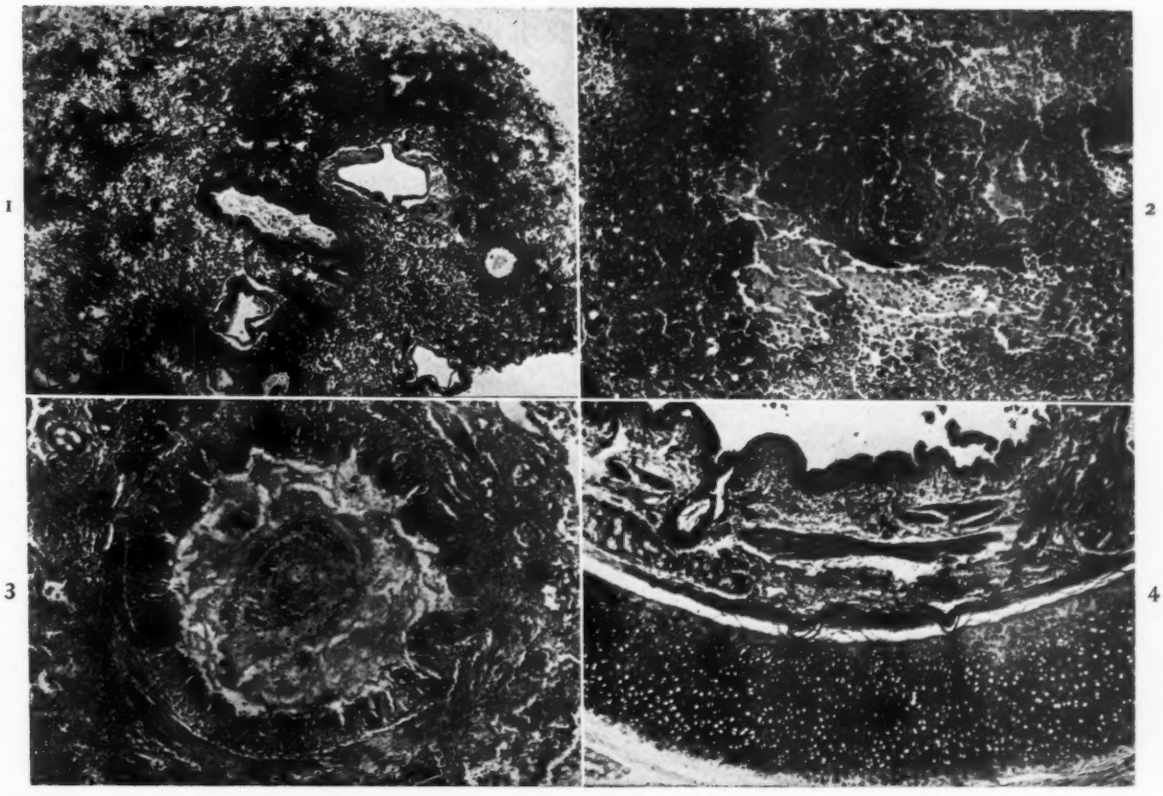

FIG. 1. Lung showing atelectasis, congestion and allergic bronchiolitis.

FIG. 2. Lung showing allergic bronchiolitis and atelectasis.

FIG. 3. Lung; bronchus showing mucoid material and cellular exudate completely obstructing the lumen.

FIG. 4. Trachea; allergic tracheitis. Note striking edema of basement membrane of mucosa.

improve the pulmonary situation with intravenous aminophylline and 50 per cent glucose.

The patient's condition did not improve, and on the morning of the third day after operation the blood pressure gradually dropped again in spite of transfusion. The temperature rose to 107°F., oliguria developed, and the patient became pulseless and died sixty-four hours after the administration of the original intravenous fluid.

The clinical impression was that the patient had an overwhelming infection with bronchopneumonia. A postmortem examination was performed. Autopsy bacteriology: Culture of heart blood and of the spleen grew Aerobacter aerogenes. Pathologic findings: The most important findings were those in the lungs and consisted of an allergic type of bronchiolitis and bronchitis with secondary widespread atelectasis. (Figs. 1 to 4.) The second important group of findings consisted of widespread focal areas of hemorrhage and foci of infarction of the myocardium and the liver, probably best explained on the basis of anoxia. (Fig. 5 to 8.) In addition the kidneys showed early lower nephron nephrosis. (Figs. 9 and 10.)

The mechanism of death based on the autopsy findings is thought to be on the basis of respiratory failure due to anoxia secondary to the allergic bronchitis and bronchiolitis, with resultant widespread atelectasis.

ETIOLOGY

It has recently become a practice, particularly with surgical patients, to give more than one bottle of intravenous solution in sequence. The second bottle may be added to a set by the nurse in charge. She follows a standard procedure to protect sterility. The most rigorous procedure does not protect against some exposure to air. The solutions, if they are commercial, are guaranteed sterile and pyrogen-free. The Fenwal system is also set up to protect against such contamination.

After these solutions are once sterilized, theorectically they should never be exposed to

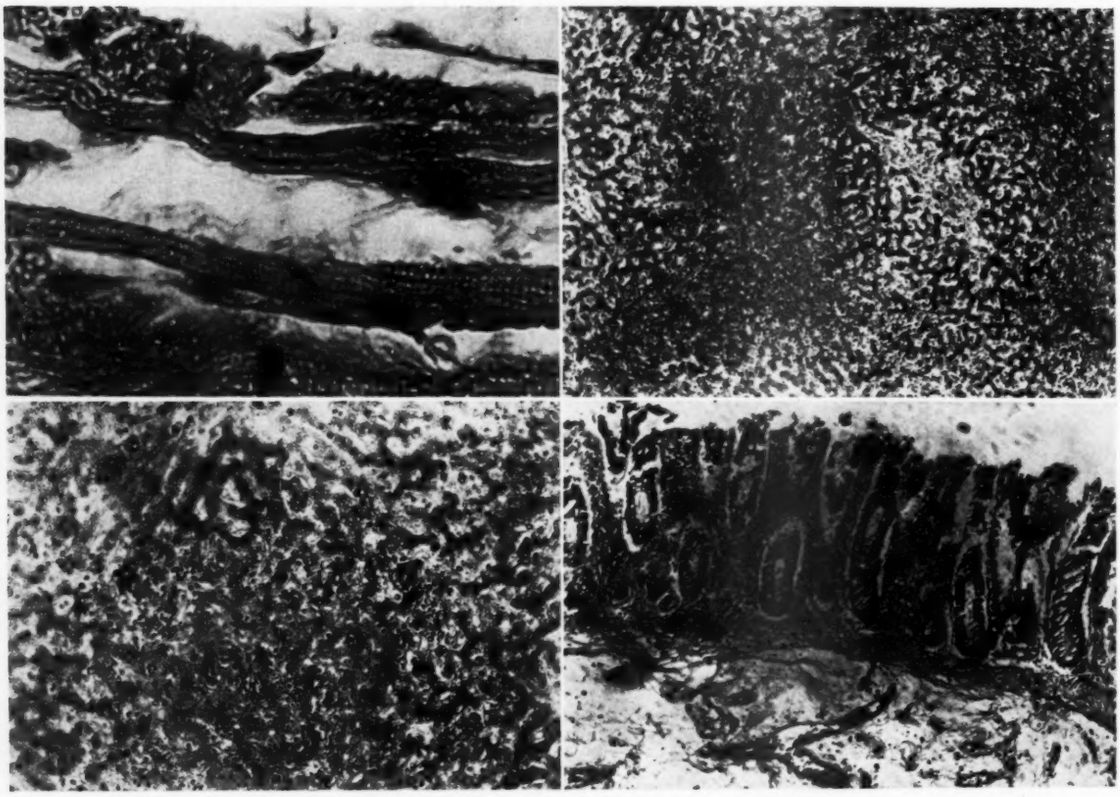

FIG. 5. Heart showing edema and clumping of cytoplasm of heart muscle fibers.

FIG. 6. Liver showing necrosis of liver cells with mild infiltration by polymorphonuclear leukocytes.

FIG. 7. Liver; necrosis of liver cells with mild infiltration of polymorphonuclear leukocytes at periphery.

FIG. 8. Large intestine showing focal areas of hemorrhage into mucosa.

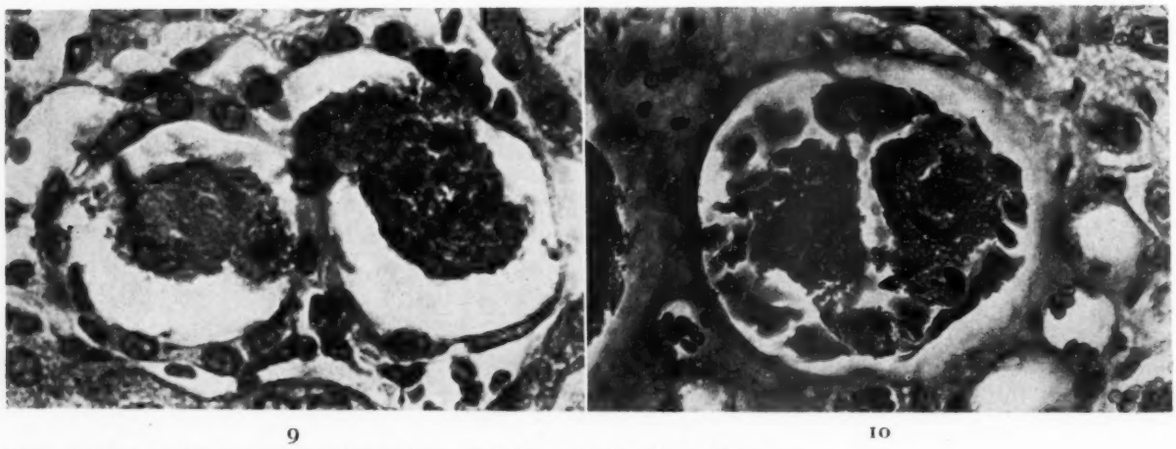

FIG. 9. Kidney; distal convoluted tubules containing granular brownish casts.

FIG. 10. Kidney; distal convoluted tubule containing abundant granular brownish material and syncytial formation of cells about this material.

the air but given to the patient in the same state as when first sterilized. Practically, when the "completer" set is attached to the bottle and the air is allowed to displace the solution, the solution becomes exposed to the environment. This is a low calculated risk. The air, although not sterile, unless in close proximity to gross contamination does little or no harm. The solution may pick up an unmeasurable number of non-pathogenic bacteria and other elements.

If, however, there has been a vacuum defect and an air leak in the cap of the bottle for a period of days or weeks, the risk is compounded. In transported commercial solutions and in warm environments this accidental exposure to contaminated environment is definitely possible. Bacteria may multiply in any dextrose solution. Still the risk is relatively low that this solution will produce any demonstrable morbidity except in two events. The first is the aforementioned exposure to severely contaminated air. The second, and reason for this paper, involves a patient's allergic or anaphylactic response to a foreign substance, which may be in the intravenous fluid as a low pathogenic bacterium or other material.

Our detection of the most probable cause, A. aerogenes, in the 10 per cent dextrose and demonstrating it to be in the solution before it was given, was determined as follows: (1) The patient had a reaction with chills, temperature up to 106°F., fall in blood pressure, and rise in pulse and respirations following the addition of a new bottle of solution to the needle already in use for two to three hours. This practically eliminates the needle, skin and tube contamination and leaves the new bottle of fluid, a delayed reaction to the older solution, or a coincidental reaction. (2) The bottle of 10 per cent dextrose in water being given at the time was cultured and grew A. aerogenes in twenty-four hours. (3) Blood culture taken at this time showed growth of A. aerogenes in four days.

The latter two might be contaminants after the fact. However, in the case of the intravenous fluid the tube was immediately knotted and the entire set left alone until the culture was taken. Also, it was the same type organism that was found in the fluid, clinical blood culture, postmortem blood culture and the postmortem spleen culture.

Three other questions needed investigation: (1) Was the entire lot contaminated originally? (2) Were any bottles in the given lot contaminated because of vacuum leak? (3) Were there many other bottles without vacuums and why?

First, it was necessary to remove and culture all the lots of 10 per cent dextrose in water in the hospital and in the retailer's warehouse. These were negative. This, therefore, answered the first question.

Second and third, in the course of checking the bottles of the retail men it was discovered that many had no vacuum. This was also true of those stored at this hospital. Cultures of all the lots of hospital glucose in water without vacuum showed no growth.

It was subsequently discovered that the manufacturer had decreased the vacuum applied to his bottles, thus increasing the risk of lessening the holding properties of the cap and leakage. Two elements might release this cap: (1) An environment at high temperature will decrease the vacuum potential; and (2) bumping in transit, particularly in this condition of decreased vacuum, would break the air-tightness of the cap without showing evidence of it grossly.

It can therefore be assumed with fair certainty that the organism, A. aerogenes, was in the bottle of solution before being given to the patient and that it was responsible for the generalized anaphylactic picture clinically and at postmortem examination.

COMMENT

Constant attention to multiple details is the price of safe surgery. In most patients a minor error of omission or commission can be tolerated by the patient with little or no mortality or morbidity. It is the very rare case that succumbs to relatively minor omissions such as in this case. A program for the care of patients or carrying out a procedure should, however, be aimed at eliminating even that rare accident.

Why do not such catastrophies occur more often? Probably the air contamination has to reach a certain level and even so, if this be anaphylaxis, the right antigen must connect with the right allergic sensitivity.

PATHOGENESIS

The literature investigated revealed no case of severe toxicity or allergy to A. aerogenes.

It did contain three cases of acute death following a second intravenous injection of a typhoid vaccine.

In addition, there were two cases of acute death following a third injection of the same type of vaccine. The clinical and pathologic findings are somewhat similar in each report and to the case under discussion. Of considerable interest in Love and Driscoll's case,[7] was the postmortem blood culture of A. aerogenes. Moreover, in all the aforementioned cases including our own several organs seemed to be maximally involved with hemorrhage and necrosis, namely, the lung, liver, kidneys, adrenal and bowel. Most of these organs are involved to a greater or lesser extent in each autopsied case.

Similar pathologic findings have been noted in the fatal blood and plasma reactions in which the solution is sterile bacteriologically and without cross match discrepancy, prior hemolysis or cloudiness.[7,15] In addition, similar deaths have occurred following the administration of blood or plasma which is contaminated particularly with the poorly hemolyzing bacteria, for example, aerial coliform and Pseudomonas pyocyanea. The clinical and pathologic findings in many of these cases simulate the case presented herein.

Also, there is considerable literature on reactions of a similar nature to serum therapy, particularly intravenous treatment.[11–14]

Because of the pathologic findings in our case, as well as others, the pathogenesis was so similar that a common etiology had to be considered. Was there a clear-cut if nonspecific toxin producing the picture described? Was the problem primarily one of a generalized allergic reaction? In view of the history in this particular case and the associated pathologic picture which is consistent, the second explanation seems to the authors to be the most likely. This would put it in the class of the Sanarelli-Shwartzman phenomenon.

Reconstructing the pathogenesis, it seems that the intravenously given antigen acts primarily on one sensitized organ. If this organ is of major importance in the bodily economy, the damage to this structure produces secondary effects in other organs, and if not controlled, eventually death.

This is an easy hypothesis to accept since it allows not only for variation in the pathology but also for various clinical pictures. However, this does not follow the original Shwartzman explanation in terms of an endotoxin producing local necrosis and hemorrhage.

SUMMARY

A fatal case of an anaphylactic reaction to intravenous solution of 10 per cent dextrose in water inadvertently contaminated with A. aerogenes is presented. The patient had a previous history of severe asthmatic attacks. Postmortem findings were similar to those described in animals demonstrating a fatal Sanarelli-Shwartzman phenomenon. The literature and possible pathogenesis are discussed.

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Cancer of the breast is rarely seen in pregnant women; but when it does occur, it is apt to follow a more fulminating course than otherwise. This is so because cancer in younger women is apt to be more malignant anyway and also because the connective tissue in older women is more dense and offers a greater resistance to extension of the primary growth. At any rate, treatment is the same whether the patient is pregnant or not. (*Richard A. Leonardo, M.D.*)

HIP NAILING IN PATIENTS OF EIGHTY YEARS OR OLDER

EXPERIENCES IN 104 CONSECUTIVE PERSONAL CASES

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FRACTURED hips are being seen with greater frequency, in part a result of the increasing age of the population. In South Dakota, where the average longevity is second in the nation, we have met the problem largely by the various hip-nailing procedures. Since the senior author performed the first hip nailing in Sioux Falls on March 9, 1937, we have nailed 104 hips in patients eighty years of age or older. Twenty-seven of these patients were treated at McKennan Hospital and seventy-seven were treated at Sioux Valley Hospital. Our series differs from others[1–3] in that it is not a summary of cases of several operators but represents entirely the consecutive personal experience of the two authors, the senior author nailing fifty-eight and the junior author forty-six hips in this age group.

The fracture is only a part of the pathology in these cases; one or more concomitant conditions are present in practically every instance. Degenerative diseases of the blood vessels, brain and heart are of frequent occurrence. As a result of deficient dentures, dietary idiosyncrasies and deficiencies, malnutrition is often seen. Incipient diabetes mellitus is not infrequently thrown into an acute phase by such an injury. In the male prostatic obstruction may become complete following a hip fracture, while in females incontinence is often seen. We are indebted to our medical colleagues for their consultation and care of these many problems. With an average longevity in the United States of 67.2 years (1948)[5] it might well be asked whether or not the efforts with this elderly group of patients have been worth while. Our answer is emphatically in the affirmative. We know of no group of patients more appreciative. Not only have they been relieved of a painful condition, their nursing care simplified, their hospitalization minimized and a more normal physiologic activity permitted, but also seven of every eight have survived the critical four weeks following surgery, the period which Boyd and George[2] have used for computing mortality in these cases.

Eighty-eight patients in this series were in the ninth decade; seventy-three or 82.95 per cent of these were females. Of the sixteen cases in the tenth decade, fifteen or 93.75 per cent were females. This high percentage of female patients is probably a result of the greater longevity of women, as well as their known predisposition to hip fractures. The oldest patients were ninety-three years of age and the average for the entire series was 84.99 years. Forty-one or 39.42 per cent were femoral neck fractures while the majority involved the trochanteric or infrequently the subtrochanteric region.

It has been our steadfast policy through these fifteen years to nail all fractured hips in which it appeared that the patient's local and general condition would tolerate the procedure, and roentgenographic examination indicated a stable mechanical result could be obtained by nailing. Certain patients with comminuted fractures have accordingly not been operated upon; with increasing experience this group is becoming smaller. The Thornton plate, the blade plate and the nail plate have permitted operation in cases which early in this series were considered inoperable.

Avoidance of pain is a most important factor in the care of these aged patients. On admission to the hospital the patient is brought directly to the orthopedic floor and gently placed in bed on a firm mattress. Skin-rubber traction with 10 pounds of weight is carefully applied to the injured extremity. Morphine sulfate in dosages of $\frac{1}{12}$ to $\frac{1}{16}$ gr. (5.4 to 4.0 mg.) is usually adequate to control the pain which is often less in femoral neck fractures than in the unimpacted trochanteric types. Only after the patient is comfortable are portable roentgenograms taken with minimal disturbance to the patient, and the status of the bony injury is determined. The common practice of transporting these aged, injured patients to

and from the roentgenographic department is mentioned only to condemn it. A thorough physical examination, blood studies, urinalysis and any indicated special examinations or consultations complete the study.

A patient who has been ambulatory previously will usually undergo surgery satisfactorily. Certain unusual physical findings should not be a cause of alarm; e.g., permanent auricular fibrillation is not an uncommon finding at this age and treatment with digitalis, while possibly desirable, is not positively needed if the patient is well compensated. With many of these chronic conditions it should be remembered that they have not prevented the patient from living far beyond the normal life expectancy, and good clinical judgment must be used in deciding how far one should go in correcting them.

Careful preoperative care, based on the individual patient's needs, is most desirable. Many of these patients quickly become dehydrated and they should be encouraged to drink frequently. A proper fluid balance must be maintained, care being taken to avoid excessive saline. Blood transfusions offer the most prompt treatment in correcting any anemia present. The increased activity and frequent changes in position following hip nailing, as well as the use of chemotherapeutic and antibiotic agents preoperatively and postoperatively, have reduced the danger of pneumonia. In this series death resulted from pneumonia in only two of our thirteen fatalities.

The timing of the operation should permit a prompt, thorough evaluation of the patient's status and any necessary preoperative correction of the same. As soon as this has been done and a decision made to operate, nothing is to be gained by procrastination. Aged patients with broken hips become progressively weaker with continuous bed rest, and accordingly, an aggressive and decisive attitude is taken.

Our choice of anesthetic agent in poor-risk patients is procaine hydrochloride (novocain®), injected directly into the fracture hematoma as well as laterally at the site of incision. While the patient is still in bed in traction, we routinely inject 2 per cent procaine hydrochloride solution into the hematoma of all fractures of forty-eight hours' duration or less. The site of injection for femoral neck fractures is posterior to a skin wheal raised 1 inch below and 1 inch lateral to the intersection of the femoral artery and the inguinal (Poupart's) ligament. In trochanteric fractures these measurements are extended by 1 inch. The pain in moving the patient to surgery and in reducing the fracture is thus greatly minimized. Experience with intravenous pentothal® at our hospitals has been previously reported;[4] it is a valuable adjunct in selected cases. In many of these elderly patients the emptying time of the stomach is prolonged; and even though food and fluids are withheld the usual length of time, there is increased danger of aspiration following regurgitation. With a local anesthetic this hazard is least, since the patient has full control of the cough and pharyngeal reflexes. Whatever anesthetic agent is used, it is important to avoid depression of the patient to more than a minimal level in a given case. Nitrous oxide and oxygen in equal concentrations are valuable as supplemental anesthesia. In patients of poor cardiac status we frequently give oxygen in higher concentrations, local anesthesia being combined with generous sedation. We have not found it routinely necessary to give blood transfusions at operation on fractured femoral necks to patients who are well prepared and on whom surgery is performed without undue delay. The blood loss with trochanteric fractures is greater than with neck fractures; we almost routinely transfuse with blood during surgery in these cases.

A carefully organized and smoothly executed surgical technic is most desirable. Closed reduction of the fracture by longitudinal traction is preferred to other manipulative procedures which may further fracture the friable bone. For the past fourteen years we have been overcorrecting our femoral neck fractures to obtain a valgus position as has been emphasized by McElvenny.[6] Two portable roentgenographic units are used. One is centered over the femoral head with the casette holder beneath the buttock; the other is placed near the inner side of the opposite knee and a special casette holder with a 3-foot handle is used to hold the plate. This loaded casette holder is covered with a double-thickness sterile pillow slip and placed just above the iliac crest for the lateral view, being held in position by one of the unsterile assisting personnel. Blind nailing of the fracture was always the method of choice except in certain instances in which satisfactory closed reduction could not be effected.

Whatever methods are used, we believe that the pounding of osteotomes, chisels and nails through cortical bone is conducive to shock and terrifying to the patient who is undergoing operation under local anesthesia. The use of an appropriate motor-driven drill not only avoids shock and possible further comminution of the fragile bone but also contributes materially to the ease and rapidity of the operative procedure. The fixation used in this series was as follows: Moore pins twenty-nine cases, Smith-Petersen nails eighteen cases, Sofield pins two cases, Smith-Petersen nail plus Thornton plate three cases, nail plate (Neufeld) twenty-eight cases, blade plate eighteen cases, blade plate plus Moore pin or pins five cases, nail plate plus Moore pins one case. The type of internal fixation to be used is dependent upon the individual case factors and is a subject greatly influenced by personal experience and preference. After hemostosis has been effected, closure of the incision in layers is followed by a snug compression dressing. For the series of 104 cases, the average operating time, which includes the time spent in exposing and developing the roentgenograms, was 68.83 minutes.

Postoperatively, early active nonweight-bearing movements, particularly of the affected leg, are encouraged. In a soundly fixed fracture pain is minimal and opiates should be used sparingly. On the second postoperative day the patient is securely bundled into a chair beside the bed. Unless the patient has previously used crutches, they cannot be expected to at this age and wheelchair ambulation is then desirable. When the patient is in bed, bedsides should always be in place as a matter of protection to both the patient and the hospital. Occasionally patients will remove the dressing from the operative site; we have not seen an infection as a result of this. An indwelling catheter may be necessary in the immediate postoperative period but it should be removed as soon as possible.

Patients who eat well and drink well, get well. The maintenance of proper nutrition is a difficult problem in many instances. These elderly patients are fixed in their dietary habits, and when placed in a strange environment with different cooking, they may eat little if anything. The patient's relatives are often of considerable aid, not only in determining what foods the patient is accustomed to, likes and will eat, but also in feeding the patient. Occasionally a patient who has been eating well loses his appetite and becomes distended; fecal impaction is prone to occur in these patients and should always be kept in mind. Some of these elderly patients have been taking commercial laxatives daily for years; in such cases it is wise to continue with the usual laxative. Generally speaking, it is better to "go along with the patient" than to expect a patient of this age to change and conform to strange routines. This policy of "going along with the patient," combined with personal interest, kindness and encouragement, will solve many postoperative problems.

Decubitus ulcers are less of a problem in the patient whose hip is nailed and who is moving about in bed and sitting in a chair or wheelchair than in those patients who must remain continuously in the recumbent position. With patients of poor nutritional status[7] decubitus ulcers are prone to occur following minor abrasions over the sacrum. It is therefore essential that this area be observed and protected in the preoperative period, in transferring the patient, in the operating room (particularly if a sacral rest is used) and in the immediate postoperative period. In several of our patients discoloration of this skin region was observed on admission. However, only in those patients who refused to eat did decubitus ulcers become a problem.

Wound infection occurred in two instances in this series. Adequate preoperative preparation of the operative area with soap and water has been an established routine in these cases; at present we are using soap containing G-11 (hexachlorophene) and have encountered no sensitivities to it. In one of our infections the process was superficial and the wound healed completely with later good bony union. In the other case with serous drainage the patient died with bronchopneumonia before the outcome of the infection could be determined.

Patients of this age cannot be readily and repeatedly called in for re-examination once they have left the hospital. Particularly during the years of World War II, the follow-up was difficult and minimal. The final roentgenologic outcome is unknown in more than half the series, so that no final conclusions can be drawn for this age group. The followed intertrochanteric fractures healed well with one known exception. We have the impression that with femoral neck fractures the incidence of aseptic

necrosis is higher in this age group than in moderately aged individuals.

All supportive measures are not sufficient to maintain patients who do not eat. This latter factor was present to a variable degree in most of our late fatalities. Thirteen or 12.50 per cent of the 104 patients expired during the first four weeks postoperatively, the period of time which Boyd and George[2] have suggested and used in computing mortality in these cases. They have reported the mortality rate of fractured hips treated by nailing at the Campbell Clinic as follows:

FRACTURES OF THE NECK OF THE FEMUR

Age (yr.)	Hips	Deaths	Mortality (%)
80–90	61	12	19.7
90–98	7	3	42.9

With trochanteric fractures in patients treated by all methods (69.5 per cent of whom were operated upon) Boyd and Griffin[3] report the following:

Age (yr.)	No. of Cases	Deaths	
		No.	%
80–90	60	23	38.3
90–96	9	7	77.8

Bickel and Jackson[1] in reporting on 126 patients treated at the Mayo Clinic by various methods, do not give the mortality of those in the ninth and tenth decades. It should again be noted that these statistics represent the treatment and operations of several surgeons, in contrast to the present series.

An analysis of our fatal cases is shown in Table 1. It is evident that fractured hips are more lethal in elderly males than in females; a relatively higher percentage of deaths occurred in males (25.00 per cent) as compared to females (10.23 per cent). In the United States the average male dies 5.5 years earlier than the average female,[5] and this factor is evident in the mortality following hip fractures. The hazard of pneumonia, which caused two deaths early in the series, has largely disappeared with the increased use of antibiotics. Although definite conclusions cannot be drawn from such a limited number of deaths, it is evident that cardiovascular disease was an important factor in the cause of death. At this age hypertension and advanced arteriosclerosis are often present, cardiac reserve is frequently minimal, and emboli and cerebrovascular accidents are prone to occur. Despite specialized consultation and treatment certain of these patients will die. At the time of the patient's admission to the hospital it is a wise policy to discuss these various prognostic factors with the relatives, who can express their thoughts and wishes at this time. We believe that closer observation and further supportive treatment in the immediate postoperative period may further reduce the mortality ascribed to shock, which can be closely simulated by cerebrovascular and coronary accidents, pulmonary and fat embolism.

TABLE 1
FATALITIES DURING OPERATION AND FOUR WEEKS POSTOPERATIVELY

Hospital No.	Sex and Age	Type Fracture	Cause of Death
McK 44774	M, 82	Intertrochanteric	Bronchopneumonia Chronic nephritis
McK 80798	F, 91	Intertrochanteric	Cardiac failure
McK 99898	F, 93	Intertrochanteric	Inanition Refused to eat
McK 99949	M, 89	Femoral neck	Cardiac failure
McK 102886	M, 85	Femoral neck	Cardiac failure Preoperative electrocardiogram showed recent anterior wall infarction
SV 27941	F, 89	Intertrochanteric	Shock
SV 60371	F, 82	Femoral neck	Pneumonia
SV 63283	F, 84	Femoral neck	Shock
SV 68644	M, 84	Femoral neck	Pulmonary embolus
SV 83023	F, 85	Femoral neck	Cardiac failure
SV 83404	F, 92	Intertrochanteric	Congestive heart failure
SV 90068	F, 80	Intertrochanteric	Shock
SV 112705	F, 92	Intertrochanteric	Coronary thrombosis 3 wk. postoperatively

SUMMARY

A series of 104 hip nailings in patients of eighty years or older is presented; all were personally cared for and operated upon by the authors since 1937. Forty-one or 39.42 per cent were femoral neck fractures while the majority involved the trochanteric and rarely the subtrochanteric regions. The average

age of the entire series was 84.99 years. The problems peculiar to this group of patients are discussed and the methods of treatment which proved most satisfactory are presented in detail, emphasis being placed on the avoidance of pain with minimal narcosis, the maintenance of nutrition, preoperative evaluation of the patient, methods of local anesthesia, a carefully organized surgical technic and early activity following surgery. The mortality of the operation and four weeks thereafter was 12.5 per cent. The cause of death in the fatal cases is reported. The mortality rate in males was 25.00 per cent as contrasted to 10.23 per cent in females.

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Peripheral facial paralysis (like Bell's palsy), furrowed tongue and chronic swelling of the face characterize Melkersson's syndrome which occasionally may occur bilaterally. In a few instances, decompression of the facial nerve according to the Ballance-Duel technic has been done, especially in cases with bilateral involvement. Occasionally a pathologic condition is found in the mastoid bone or in the fibers of the facial nerve itself but even more often none is demonstrable. (*Richard A. Leonardo, M.D.*)

UNRECOGNIZED LEUKEMIA SIMULATING APPARENT SURGICAL CONDITIONS

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TWO cases occurring in close proximity in the experience of one of us (L. E. S.) stimulated a curiosity to inquire into any other cases in which, during the course of a presenting surgical condition, leukemia was found to be the dominating and eventually the fatal disease. In all four cases reported here the symptoms were referable to the abdomen and were acute and fulminating in three of these. All four patients died, two of them within forty-eight hours and the others after an illness which lasted less than six months. In all of these cases the underlying leukemic picture was not recognized until either a routine blood count was done or blood counts which had been performed previously were reviewed because of the chronic or indolent course of the disease and the leukemic shift of the blood count was noted. Three of the four cases were males, whose ages were seventeen, fifty-three and sixty-one years. Two of the patients were operated upon and two were not. One of the latter refused operation and the other deteriorated so rapidly that surgery could not be done. Of the two that were operated upon, one presented a picture of an acute condition of the abdomen due to a perforated viscus and in whom at operation there were no findings of any surgical condition; the other patient had x-ray evidence of calculi in the gallbladder and was subjected to a cholecystectomy at another hospital and came to the attention of one of us (L. E. S.) five weeks later because of a poorly healing wound.

A search of the literature as well as several textbooks including some on hematology failed to reveal any information which associated leukemia with acute or chronic abdominal surgical conditions other than to state that occasional abdominal pain sometimes occurs. Discussions with several internists and hematologists did not disclose any such cases in their experience. It would be interesting to know the incidence of this association in the experience of others.

Leukemia is a condition in which there is proliferation of the leukoblastic tissue of the body: myeloid, lymphoid, monocytic or primitive stem cells. In chronic leukemia the onset is usually insidious. Very often the patient complains only of symptoms due to the anemia. In some cases the patient complains only of a dragging sensation in the left upper quadrant due to splenic enlargement. Hemorrhages may appear in the skin, eyes or mucous membranes. Fever is common in the later stages of the disease; however, some cases may start with acute fever. The average duration of life is two and a half to three and a half years; however, in about 10 per cent of cases the patient may survive five to ten years after onset of symptoms. In the terminal states there is emaciation, increasing anemia and fever. Hemorrhagic tendencies develop and death ensues.

Acute leukemia is a disease of early life. It is most common in the first decade and rarely seen over the age of twenty-five years. The onset is usually abrupt with symptoms at first thought to be due to an acute upper respiratory infection. There is high fever, unusual prostration and a rapidly developing anemia which usually calls attention to the possibility of the disease. Spontaneous hemorrhagic tendencies are commonly present. The disease frequently follows a fulminating course. More than 75 per cent of the patients die within six to eight weeks after onset of symptoms and 20 per cent die within two to three weeks. Very rarely the acute form will change spontaneously to the subacute or chronic phase.

CASE REPORTS

CASE 1. C. S., a sixty-one year old white female, was admitted to the hospital on October 28, 1949, with a necrotic, discharging, post-cholecystectomy wound, marked weakness and a severe anemia. A cholecystectomy had been performed elsewhere for gallstones five weeks previously.

Routine laboratory work-up revealed the following: Blood count: hemoglobin 38 per cent, red blood cells 2.22, white blood cells 4,800 with polymorphonuclear cells 23 per cent and lymphocytes 77 per cent; hematocrit 19 per cent. Blood chemistry, liver function tests, blood culture, blood fragility and scout films of the abdomen were all within normal limits. She was given a blood transfusion and antibiotics. A provisional diagnosis of lymphatic leukemia was made because of the high lymphocyte count. A further history was elicited that prior to her operation she had been under the care of another physician for several years. Inquiries were made from the operating surgeon and from her previous physician.

From the records of her case at the hospital where she had been operated upon, the following blood counts were recorded:

Date	Hgb.	R.B.C.	W.B.C.	Poly.	Lymph.	Mono.
9/12	50	2.39	3,600	8	85	7 Poikilocytosis, anisocytosis, hypochromia
9/28	37	1.86	7,600	40	52	2
10/4	50	2.61	4,600	40	56	3
10/10	47	2.20	5,250	50	41	3

All other laboratory tests were within normal range. The pathologic diagnosis of the gallbladder was chronic cholecystitis and cholelithiasis.

It is apparent that the blood counts reveal a severe anemia in spite of several blood transfusions, a leukopenia and a relative high lymphocytosis. A plausible explanation of this blood picture was not given.

The following information was obtained from her previous physician: She had been under his care from 1938 until August 19, 1949. She had had a fibroid tumor removed in 1932. In February, 1949, she was admitted to the hospital because of cramps, diarrhea and fever. Mild jaundice developed which lasted over one week. In July, 1949, x-rays of her gallbladder revealed calculi. Blood studies while under his care showed the following:

Date	Hgb.	R.B.C.	W.B.C.	Poly.	Lymph.	Mono.
3/8/49	65	3.3	5,400	57	33	2 Poikilocytosis, anisocytosis
5/6/49	90	4.6	4,500	43	55	2
7/9/49	70	3.3	4,450	40	53	7
8/19/49	76	3.6	5,500	38	48	14

It will be noted here that she showed a leukopenia with a relative lymphocytosis. It seems reasonable to state that the leukemia may have begun at this time.

Having obtained this information from her past history the diagnosis of lymphatic leukemia seemed fairly certain. This was corroborated by another blood count which again showed a lymphocytosis of 80 per cent. A hematologic consultation was obtained and after sternal puncture and another blood study a diagnosis of acute monocytic leukemia was made. She was treated with blood transfusions, vitamins and antibiotics. The necrotic wound improved slightly but bled easily on manipulation. She ran a spiking temperature course between 99°F. and 102°F. She was placed on crude liver extract and after she had improved somewhat she was discharged on November 20, 1949, with instructions to her family physician to continue transfusions and crude liver extract. After that she continued to go downhill rather rapidly and several weeks later she died.

CASE II. A. H., a sixty-one year old white male, was admitted to the hospital on September 10, 1949, with severe abdominal pain mainly in the right lower quadrant which began several hours previously while he was playing golf. The pain was associated with vomiting. The pain and vomiting had increased in intensity from the time of onset. Previous to that he had some nausea and therefore ate very little. He had had several such episodes during the past year and x-rays of his gastrointestinal tract several months ago were negative. The patient was said to have leukemia for which he had received irradiation several months ago.

On physical examination the patient was in acute distress. There were some rales in the lower lobe of the right lung posteriorly. The abdomen was very rigid and board-like with marked diffuse tenderness especially in the right lower quadrant. The temperature was 103.0°F. A blood count showed hemoglobin 10 gm., red blood cells 4.5 and white blood cells 3,500. Unfortunately, a differential white cell count was not done because the patient came in late Saturday night when the regular technician was not on duty and the true nature of the disease was not apparent.

The patient presented the typical clinical picture of a ruptured viscus with a spreading generalized peritonitis. The only demurrer was the leukopenia which was explained by the

patient having received irradiation which destroyed many of the white cells. A scout film of the abdomen failed to reveal air under the diaphragm or other information which might be of help. An x-ray of the chest was normal. A discussion naturally arose whether to operate on a patient who has leukemia. It was finally decided that the symptoms and signs were so typical of an acute surgical condition of the abdomen that to stay out of the abdomen would be more hazardous than to operate. The operation was performed the same night.

Through a right rectus incision the entire abdomen was explored. There were no signs of a ruptured viscus or other acute pathologic involvement of any of the organs. There were numerous firm nodes in the mesentery measuring up to 1 cm. in diameter. Near the ligament of Treitz at the duodenal-jejunal junction retroperitoneally was a mass of nodes measuring about 6 cm. in diameter. Some of these nodes were firm and others were soft, some discrete and some confluent. Although some of them appeared red, there was no acute inflammation, suppuration or rupture of these nodes. The first 3 feet of jejunum appeared somewhat dilated. The gallbladder appeared normal and some bile aspirated from it was clear. There were numerous small calculi in the gallbladder. A cholecystectomy was easily and quickly performed removing an enlarged lymph node alongside the cystic duct. The abdomen was closed in layers. The pathologic report of the gallbladder showed cholelithiasis.

The following day the patient was dyspneic with marked abdominal distention and complaining of severe abdominal pain. Five hundred fifty cc. of greenish fluid was aspirated from the stomach. Later that night his breathing became shallow and he was very apprehensive. The blood pressure was 90/60. He was given a blood transfusion of 1,000 cc. with 1 unit of plasma. This had little effect, as did caffeine sodium benzoate, on his respiratory difficulty. He was placed in an oxygen tent. The following morning his condition was worse and he became semi-comatose. There were numerous rales and rhonchi in both lungs. The skin was cold and clammy. The blood pressure was 80/50 and the pulse 180 per minute. The temperature rapidly rose to 107°F. and he expired at 2:00 P.M. that afternoon.

The autopsy findings showed the following: (1) acute glomerulonephritis; (2) lymphatic leukemia of the lymph nodes and the bone marrow; (3) thrombus in the pulmonary artery; (4) atelectasis with edema of the lungs; (5) ecchymosis in the pericardium and pleura; (6) diverticulosis of the colon; (7) cyst of the right kidney; (8) congestion of the viscera.

A letter was sent to New York Polyclinic Hospital where he was a patient from May 10, 1949, to May 24, 1949. The record there showed that he had been admitted with epigastric pain and vomiting similar to attacks he had in previous months. These were unrelated to food intake. There were no tarry stools. The diagnosis was duodenal ulcer, secondary anemia, cholecystitis and chronic lymphadenopathy. A biopsy was taken of a lymph node in the neck which showed lymphatic leukemia.

In commenting on this case it is believed that there was more than sufficient justification to operate on this patient when he was admitted because of the acute history and the abdominal signs of a ruptured viscus with spreading peritonitis. The only criticism which can be made is the wisdom of removing a calculous gallbladder which did not contribute to the acute clinical picture which this patient presented. Whether this additional surgery contributed to the death of this patient is doubted. This patient would no doubt have died from the acute lymphatic leukemia because of the fulminating nature of this last attack even if he had not been operated upon.

CASE III. V. C., a seventeen year old white male, was admitted to the hospital on November 16, 1949, complaining of pain in the abdomen. Three days before admission the patient developed sharp, intermittent abdominal pain occurring every five or ten minutes and lasting about two minutes. The pain began in the paraumbilical region and radiated to the right side of the abdomen. In the first day of his illness he vomited twelve times and a bowel movement contained dark red blood. He also had pain in both legs. In June, 1949, he had an episode of fever and developed some lymph gland enlargement. A biopsy of an inguinal lymph node was taken and a diagnosis of leukemia was made. He received some treatments at the Memorial Hospital. On the day of admission to the hospital for the present illness he noted bleeding from his gums.

On physical examination the temperature was 103.6°F. and the pulse was 120 per minute. He appeared pale and in acute pain. He had

abdominal spasm and tenderness in the right side, especially in the right upper quadrant. He had pitting edema and generalized tenderness over both lower extremities. The impression was that he may have an acute surgical abdominal condition.

A blood count revealed the following: hemoglobin 8.5 gm., white blood cells 72,000 with 35 per cent lymphocytes and 44 per cent lymphoblasts. The patient refused to be operated upon. He bled from the nose repeatedly and in spite of repeated blood transfusions and nasal packing he expired the morning after admission.

CASE IV. S. A., a fifty-three year old white male, was admitted to the hospital with complaints of lower abdominal cramps and diarrhea which began twenty-six days previously. The diarrhea persisted to the time of admission with three to four watery stools per day. On several occasions the stools were said to be tarry in color. Three weeks prior to admission chills developed and his temperature rose to 102°F. This was associated with anorexia, severe nausea and vomiting after eating, weakness and a loss of 10 pounds in weight. A gastrointestinal x-ray series was said to be normal.

Physical examination revealed an obese white male who complained of severe pain in the region of the anus which was found to be due to a thrombotic hemorrhoid. The temperature was 100.6°F. The tonsils were enlarged and were displaced anteriorly and toward the midline; this was due to the presence of walnut-sized masses of pink hemorrhagic tissue which was attached to the posterior surface of each tonsil. The patient did not complain of any pain or discomfort in his pharynx. There was no lymphadenopathy. The liver appeared to be one fingerbreadth below the costal margin. The spleen was not palpable.

Laboratory work-up including blood chemistry, liver function tests, serology and urine analysis were all within normal limits. Blood count showed the following: hemoglobin 60 per cent, red blood cells, 3,830,000, white blood cells 480,000 with evidence of myeloblastosis. A bone marrow study also showed myeloblastosis.

The day after admission to the hospital the gums became heaped-up and spongy. There was slight bleeding from the lymphoid tissue attached to the tonsils. The patient's condition became gradually worse and he expired six days after his admission to the hospital. The clinical impression was that this was an acute exacerbation of a chronic myelogenous leukemia. Permission for a postmortem examination was not granted.

SUMMARY

1. Four cases of leukemia are presented, all of which had abdominal symptoms which simulated apparent surgical conditions most of which were acute.

2. It is noted that the literature on leukemia contained practically nothing mentioning this association.

3. The difficulty in diagnosis is emphasized especially when the abdominal signs are acute.

4. The point is made that every patient with an apparent abdominal surgical condition, especially with acute signs, should have a complete blood count including a differential of the white blood cells. More attention should be focused on the blood count no matter how definite the clinical diagnosis appears to be.

ANESTHESIA FOR INTRACRANIAL SURGERY*

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WHEREVER neurosurgeons gather for scientific discussion the name of Harvey Cushing receives due recognition for his contributions to this field of medicine. It is less commonly known, however, that he made valuable contributions to the specialty of anesthesia. Harvey Cushing administered anesthetics before he practiced surgery. Because of this early experience, with frequent unfortunate results, he introduced the "ether chart," which was a system of continuous recording of pulse and respiration during anesthesia. When he brought the Riva-Rocci blood pressure apparatus from Italy, he added continuous blood pressure recording to the "ether chart."[1] These charts stand historically as one of the important early American contributions to the practice of anesthesia. Identical records are still an essential aid in the conduct of neurosurgical anesthesia.

The choice of anesthetic agents and technics for intracranial surgery is determined by an evaluation of (1) the physical status of the patient, (2) the requirements of the surgical procedure and (3) the agents and methods which assure the greatest safety to the patient.

The patient may have one or more neurophysiologic disturbances which are surgical and anesthetic hazards and which are inherent in the nature of his illness: increased intracranial pressure, impaired consciousness and depression of medullary centers. The anesthesiologist must compensate for their deficiencies and avoid aggravating their severity.

Increased intracranial pressure, insofar as it is primarily due to the expanding lesion within the rigid cranial vault, is not within the control of the anesthesiologist. There is, however, another cause of increased intracranial pressure which the anesthetist should prevent or minimize, namely, cerebral congestion. The rate of blood flow and the blood volume in the brain are mainly controlled by the concentrations of oxygen and carbon dioxide in the blood, and by the arterial and venous pressures. Variations in the supply of oxygen and carbon dioxide to the brain produce alterations in the cerebral vascular bed, with corresponding changes in brain volume and intracranial pressure. Hypoxia damages capillary walls so that their increased permeability permits the leakage of fluid to produce cerebral edema. An excess of carbon dioxide dilates the cerebral vascular bed with consequent congestion and swelling of the brain.[2] Usually both hypoxia and hypercarbia accompany each other as a result of respiratory depression or obstruction, or other interference with adequate pulmonary ventilation.

Elevation of blood pressure in either the arterial or venous channels, or both, is often related to the same factors responsible for hypoxia or hypercarbia. Indeed, the usual cause of arterial hypertension during anesthesia is the accumulation of excessive carbon dioxide with or without the presence of hypoxia. Arterial hypotension is associated with decreased cerebral congestion and has recently been recognized as a desirable feature of anesthesia for intracranial surgery. The principal cause of unusual congestion, however, is increased venous pressure. This is commonly due to interference with venous return by malposition of the head or increased intrathoracic pressure. The latter factor is especially common as a result of varying degrees of respiratory obstruction, mechanical resistance to respiration in the anesthetic equipment, and struggling or straining during anesthesia.

Our patients are divided into the two broad categories of good and poor surgical risks on the basis of their intracranial pressure and the state of consciousness. In the presence of coma or marked impairment of consciousness regional anesthesia is preferred. Nevertheless an endotracheal tube is essential to obtain an unobstructed airway, to permit tracheobronchial toilet and to administer O_2 throughout the

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operation.[3] Also, with endotracheal intubation the anesthetist and anesthetic equipment is removed from the surgical field. In case of respiratory arrest artificial respiration can be promptly instituted by rhythmic manual compression of the breathing bag of the anesthetic machine without interference with the operation. Not infrequently, as intracranial tension is relieved by the operative procedure, the state of consciousness is improved and the patient becomes restless. The presence of an endotracheal tube facilitates induction and maintenance of general anesthesia should it become necessary. Endotracheal intubation is usually performed easily by the blind nasal technic following cocainization of the nasal passages, pharynx and larynx.

When consciousness is impaired only moderately, or not at all, the patient is best managed under a general anesthetic. A long and meticulous operation under local anesthesia is an ordeal for both the surgeon and the patient. Restlessness and straining lead to increased intracranial pressure. Under local anesthesia it is usually necessary to premedicate with large doses of depressant drugs which impair vital functions and further increase intracranial pressure.

Among the requirements especially characteristic of intracranial procedures is the use of the high frequency current for cutting and coagulation. To avoid the danger of an anesthetic explosion or fire it is mandatory to administer a non-combustible anesthesia.[4]

The position of the patient on the operating table requires careful consideration. Pressure points must be adequately padded. Excessive turning of the head to one side, or sharp flexion, may produce compression of the cervical veins with consequent cerebral congestion. Circulatory and respiratory distress may result from extreme variations from the supine horizontal position, which is the one best tolerated by the anesthetized patient. The prone horizontal position interferes with the movement of the anterior chest wall and the diaphragm. It is therefore necessary to provide lateral supports to raise the chest and abdomen off the operating table. Circulatory failure may occur as the result of pooling of blood in the dependent splanchnic vessels in a deeply anesthetized patient. In the sitting position there is the least interference with costal respiration. There is, however, a tendency for pooling of blood in the legs and visceral area. Elevation of the lower extremities to the cardiac level compensates for the effect of gravity. In this position even small losses of blood or brief periods of hypoxia may damage the cerebral cortex.

We may, therefore, summarize the requirements for the anesthetic management of the patient for intracranial surgery: (1) Regional anesthesia for the comatose patient; general anesthesia for all others. (2) Quiet induction and recovery without struggle, straining or vomiting. (3) Full control of a patent airway, with means for clearing of secretions and for manual control of respiration if necessary. (4) Avoidance of depression of respiration and circulation by premedication or anesthetics. (5) Prevention of hypoxia and hypercarbia. (6) Employment of non-explosive anesthetic technics. (7) Removal of anesthetic personnel and equipment from the surgical field. (8) Compensation for postural disadvantages on the operating table. We have adopted anesthetic principles and technics which meet all these requirements.

For premedication opiates and other depressant drugs are not used. Even a small dose of a respiratory depressant may be dangerous or fatal in the presence of increased intracranial pressure, which in itself produces latent or obvious depression of the respiratory center. The only drug used is atropine in relatively large doses. The absence of sedation has not prolonged the induction period.

Many combinations of anesthetic drugs and technics have been employed. Before the wide acceptance of endotracheal anesthesia rectal avertin® supplemented by local field block was the most popular method. Rectal avertin, however, is often accompanied by relatively fixed respiratory and circulatory depression with consequent hypoxia and hypercarbia. Respiratory obstruction may occur and resist correction. Avertin basal anesthesia is frequently followed by a prolonged period of narcosis with depression of the cough reflex. Without an endotracheal tube there is no provision for tracheobronchial toilet or control of pulmonary ventilation in the event of respiratory failure. Since the dose of avertin must be estimated beforehand, the effect is unpredictable.

While cyclopropane and ether, with an endotracheal tube, may meet many of the criteria for anesthesia for intracranial surgery,

the danger of explosion is a very serious drawback. Of the non-combustible agents nitrous oxide is too weak to provide adequate anesthesia without hypoxia; pentothal® in adequate dosage may produce serious depression of respiration and circulation and a prolonged postoperative recovery period. However, pentothal and nitrous oxide can be so combined as to utilize their advantages and minimize or entirely eliminate their disadvantages.[5] This combination permits the administration of an anesthetic atmosphere rich in oxygen, while the amount of pentothal required is greatly reduced. We have never exceeded 2 gm. of pentothal in operations lasting up to seven hours; we have usually managed with 1 gm. The smallest dose was 0.5 gm. for a three-hour operation. All our patients are intubated so that complete control of the airway and respiration is maintained at all times. Furthermore, the presence of the endotracheal tube enables us, routinely, to perform a thorough tracheobronchial toilet before returning the patient to his bed. The value of this single procedure can be best demonstrated by the fact that we have had no instance of postoperative atelectasis or pneumonia in our entire series. We have, therefore, adopted a cyclopropane-ether-nitrous oxide-pentothal sequence.

Induction of anesthesia is rapidly accomplished with cyclopropane-oxygen. Ether is then gradually added and cyclopropane is discontinued. When a suitable level of anesthesia is reached, orotracheal intubation under direct vision is accomplished. The patient is then placed in the desired position on the operating table and the operative site is prepared; finally the patient and anesthetic equipment are wheeled into the operating room. Cyclopropane is chosen because it produces a rapid and pleasant induction with little or no excitement. The ether provides a relatively stable level of anesthesia for intubation and positioning of the patient. Without ether there is a tendency for rapid emergence and "bucking" on the tube during positioning.

After the patient is in position and the preparation of the field has begun a 0.2 per cent pentothal infusion is started and the anesthetic atmosphere is replaced by the nitrous oxide-oxygen mixture (60-40 or 50-50) in a semi-closed circle absorption system. By the time the operation is started the danger of combustible concentrations of ether or cyclopropane has been eliminated and maintenance is continued with the pentothal-nitrous oxide-oxygen combination.

At the close of the operation and before extubation a thorough tracheobronchial toilet is performed when the laryngeal and pharyngeal reflexes are active. Unless the intracranial damage is such as to preclude early return of consciousness, our patients are fully awake within one to two hours after completion of the operation. Early awakening is essential in order to avoid masking any depression due to neurologic or surgical complications.

In infants and young children one must consider the harmful effects of a prolonged period of breathing through an increased dead space and the resistance to breathing created by the anesthetic equipment. In these patients induction is accomplished with an open drop technic employing vinethene® and ether; anesthesia is then maintained by oxygen-ether insufflation through the use of a T-tube connection to an endotracheal catheter. By this means there is a sharp reduction in respiratory dead space, no resistance to breathing and no accumulation of carbon dioxide. The use of ether introduces a combustible atmosphere. This danger, however, must be weighed against the greater hazard of physiologic disturbances induced by any alternative technic. Precautionary measures are employed to minimize the risk of combustion. Special non-permeable drapes are placed by the surgeon. The anesthesia and cautery equipment are widely separated. Continuous suction is set up through a catheter placed near the expiratory end of the T-tube in order to remove the combustible atmosphere. (Fig. 1.)

Trichlorethylene, a non-combustible inhalation agent, has been extensively used in England to potentiate the anesthetic action of nitrous oxide. It is believed that this combination might provide an equally safe, but non-combustible anesthetic mixture for intracranial surgery in children. It is our intention to explore its use when the equipment becomes available to us.

With endotracheal intubation in infants and children there is the possibility of laryngeal edema as a postoperative complication. The following measures have been adopted to avoid this: (1) Atraumatic intubation: The size of the tube selected favors easy introduction through the larynx. No attempt is made to

produce a tight fit. (2) Use of portex plastic endotracheal tube: This material is non-kinkable and non-irritating. At body temperature it tends to mould itself to the contour of the trachea and larynx and thus avoids undue pressure upon the laryngeal structures.

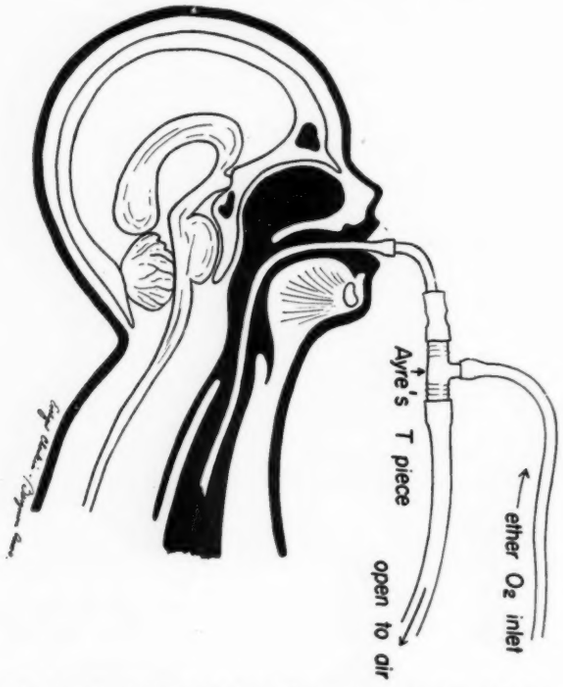

FIG. 1. Endotracheal insufflation technic for children.

(3) Sterilization of the endotracheal tubes: There has been no case of laryngeal edema in this series.

It is a wise precation to appraise the effects of angiography on the laryngeal and pharyngeal structures before undertaking anesthesia for craniotomy.[7] We have seen two cases of laryngeal edema and ecchymosis in adults following percutaneous carotid angiography. In one, surgery was deferred in order to permit the swelling to subside.

Prophylactic tracheostomy should be considered preoperatively under the following conditions: (1) edema and ecchymosis following angiography; (2) paralysis of pharyngeal and laryngeal muscles; (3) severe respiratory muscle impairment; (4) when unconsciousness is expected to persist for a long time in a patient with a wet tracheobronchial tree.

Control of circulation is as important as control of respiration in the safe conduct of anesthesia for intracranial surgery. A patent vein is always maintained. Immediately after induction of anesthesia an infusion of normal saline or lactated Ringer's solution is started, either through a "cut-down" or a large bore Lindeman needle. Five per cent glucose in water is avoided. Wilson and co-workers,[6] in experimental work on dogs, have shown that it increases intracisternal pressure by almost 100 per cent, whereas normal saline or Hartmann's solution does not produce any change in intracisternal pressure. Blood is replaced only as indicated. In our experience the estimated average blood loss has been about 500 cc.; the major part of this loss occurred when the hemostats were removed for closure of the scalp wound.

In patients with highly vascular tumors or in those operations where excessive blood loss is anticipated, the use of induced hypotension is now being considered. Three methods have been recommended: (1) exsanguination with return of the blood through arterial infusion at the end of the operation;[8] (2) total spinal block to paralyze the preganglionic sympathetic outflow;[9] and (3) ganglionic blocking with hexa- or penta-methonium halides.[10,11] Hypotension due to arteriolar dilatation is not dangerous provided blood volume is normal, cardiac output is adequate, and a patent airway with good oxygenation is maintained.

The exsanguination procedure is a cumbersome one and the reduced blood volume during operation presents many theoretic objections. Spinal blockade of the sympathetic nervous system requires the introduction of continuous spinal equipment for the controlled use of a dilute anesthetic agent whose concentration produces only a sympathetic block. The blocking effect of the methonium compounds is obtained more simply and seems to produce minimal physiologic disturbance. Preliminary studies have not demonstrated impairment of hepatic, renal or cardiovascular functions.

We are now conducting a study of cases with controlled hypotension using hexamethonium bromide as the ganglionic blocking agent. This study will form the basis for a subsequent extended report. For the present I may briefly describe the technic.

After the bone flap is turned down and the dura exposed, hypotension is induced by the intravenous injection of 25 mg. of hexamethonium bromide. If the optimum blood pressure of 70–80 mm. mercury systolic is not reached in two minutes, the dose is repeated one or

more times at two-minute intervals until the desired hypotensive level is attained. With the fall in arterial pressure there is a concomitant drop in intracranial pressure as evidenced by a reduction in the tension of the dura.

During the period required for hemostasis and removal of the specimen the hypotensive state is maintained by a continuous drip of a solution containing 100 mg. of the hexamethonium per 500 cc. normal saline (the rate of flow varying with the requirements). Before closing the dura the blood pressure is returned to and maintained at a near normal level with a neo-synephrine® drip (10 mg. per 500 cc. saline) intravenously, the rate of flow being determined by the blood pressure response. Renewed bleeding is controlled and the closure completed. Blood replacement is maintained throughout the operation in pace with the estimated blood loss. The immediate postoperative period requires close supervision by experienced personnel to maintain the normotensive state with the neo-synephrine drip and elevation of the legs. It is our impression that these operations have been appreciably facilitated and the blood loss and operative time markedly reduced as a result of the hypotensive state.

The general considerations expressed in this discussion of anesthesia for intracranial surgery have been tested by my personal experience with 102 cases at The Mount Sinai Hospital since February, 1951. The ages of the patients varied from one to seventy-two years; of these fifteen were children twelve years old or less. Coma was present before operation in sixteen patients; of these, six died after operation—a mortality rate of 37 per cent. Many of these patients were moribund preoperatively. All of the deaths were due to the intracranial disease. A salvage rate of 63 per cent (ten patients) is therefore quite satisfactory. In the non-comatose group there were eighty-six cases: five died in the hospital—a mortality rate of 6 per cent. Two of the deaths were caused by thalamic damage inevitably associated with the specific operative procedure. The other three were sudden in patients with known cardiovascular disease; of these, one occurred during induction of anesthesia and the other two on the fourth and twenty-fourth postoperative days, respectively. There was no instance of postoperative atelectasis or pneumonia in these 102 cases.

SUMMARY AND CONCLUSIONS

Anesthesia for intracranial surgery has benefited by the many advances that anesthesiology has received in the past ten years. It is quite different today from that of the Cushing era.

Optimum anesthetic management in our opinion requires: (1) Endotracheal intubation to provide a clear airway, assure respiratory control and permit routine tracheobronchial toilet. (2) Accurate control of circulation, both systemic and intracranial, venous and arterial. (3) Freedom from the hazard of anesthetic combustion. (4) Facilitation of surgery by the induced controlled hypotensive state under special circumstance.

With strict adherence to these principles anesthesia for intracranial surgery can be made as safe as it is for any other type of major surgery. It can facilitate the work of the neurosurgeon and reduce the postoperative anesthetic morbidity and complications to a minimum.

Addendum: We have modified our technic for inducing and maintaining the controlled hypotensive state. The ganglionic blocking agent now used is pendiomide® (pentamethyldiethyl-3-aza-pentane-1,5-diammonium-dibromide), whose action is of shorter duration and, therefore, more controllable than hexamethonium. A solution containing 200 mg. of pendiomide in 250 cc. of normal saline is administered as an intravenous infusion during the period of desired hypotension, the flow rate varying with the blood pressure response. Induction of the hypotensive state is accomplished with a rapid initial flow. The normotensive state is restored with neo-synephrine as described previously. The period during which a vasopressor is required is of much shorter duration than following hexamethonium-induced hypotension. Very often the vasopressor can be discontinued before the patient leaves the operating room.

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Progressive dysphasia, regurgitation of food and loss of weight and strength are some of the suggestive symptoms of esophageal cancer. The diagnosis can be made definite by x-ray studies, and esophagoscopy permits of biopsy to ascertain whether malignancy is present and if it is a squamous cell carcinoma or an adenocarcinoma. The former occurs three to four times more frequently. About 80 per cent of these malignant lesions are found in the middle or lower third of the esophagus and frequently the adjacent lymph nodes or even adjoining anatomic structures are involved. Many of these malignant growths are situated at the level of the aortic arch, or higher, and these metastasize to the mediastinal and occasionally to the cervical glands. The condition is considered operable even if the subdiaphragmatic glands are involved so long as the mediastinum remains clear. (*Richard A. Leonardo, M.D.*)

RETROCAVAL URETER*

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HOCHSTETTER in 1893 was apparently the first to report the occurrence of retrocaval ureter in man. The anomaly was discovered on routine dissection in an infant several weeks old during the course of Hochstetter's research on the development of the venous system.

Heslin and Mamonas, in reviewing the literature in 1951, reported forty cases of retrocaval ureter to which they added four. An analysis of these cases follows: (1) Twenty-two cases were discovered antemortem. Of this number, eight were diagnosed preoperatively and confirmed by operation and thirteen were discovered at operation. (2) One of the cases was diagnosed on pyelographic evidence alone but the patient refused operation. (3) There were nine successful plastic repairs. The remaining twenty-two cases were discovered either on postmortem examination or on routine anatomic dissection.

Of the total number of cases reported the occurrence of this anomaly in males to females was in the ratio of 3 to 1, and in the operative cases in the ratio of 2 to 1. Although an insufficient number of cases are on record to draw any definite conclusions, the above-mentioned ratios would seem to indicate that the anomaly is more common in men.

Embryologically, retrocaval ureter is the result of an error in the development of the vena cava and not of the ureter, as one might suspect. The permanent kidney or metanephron develops in the pelvis and ascends to the lumbar region, attaining its normal position about the twentieth week of life *in utero*. During its ascent the kidney passes through a circle of veins known as the perimetanephric or the periureteric ring. Dorsally this circle of veins is composed of the lumbar division of the supracardinal vein and subcardino-supracardinal anastomosis (after McClure and Butler 1925) or the sacrocardinal vein (after Gruenwald 1938). Ventrally the ring is made up of the lumbar division of the postcardinal vein and subcardino-postcardinal anastomosis and the sacrocardinal vein.

Normally the postrenal portion of the inferior vena cava develops from the dorsal limb of the perimetanephric ring, and hence the ureter lies in an antecaval position. Persistence of the ventral limb with resolution of the dorsal limb or failure of development of the dorsal limb will result in retrocaval ureter. Persistence of both ventral and dorsal limbs will result in the ureter passing between the cavae.

Four types of retrocaval ureter have been observed in man: (1) Bilateral retrocaval ureter which is due to bilateral persistence of the postcardinal vein. Gladstone's case, that of an acardiac monster, is the only example on record to date. (2) Right-sided postcaval ureter which is the commonest type. (3) Double vena cava on the right, with the ureter passing between, which is the result of persistence of the ventral and dorsal perimetanephric limbs. (4) Double vena cava, consisting of one on each side with the ureter passing retrocavally on the right.

There is no definite gamut of symptoms and signs pathognomonic of postcaval ureter. The clinical picture may vary from no symptoms to that of marked involvement of the urinary tract. The symptomatology is dependent upon the development of obstructive phenomena on the basis of ureteral kinking, stricture, compression or a combination of these factors.

Ordinarily the diagnosis can be made upon retrograde study alone; however, in the case to be presented it will be evident that both intravenous urography and retrograde pyelographic study were essential.

The following roentgenographic features are peculiar to this anomaly. Anteroposterior views disclose hydronephrosis with a dilated and elongated proximal ureteral segment which then courses abruptly toward the midline or slightly beyond in the region of the third, fourth or fifth lumbar vertebra. This is the point at which the ureter passes retrocavally. After emerging from behind the vena cava the

* From the Department of Urology, Harrisburg Hospital, Harrisburg, Pa. Read before the Mid-Atlantic Section of the A. U. A., Philadelphia, Pa., 1952.

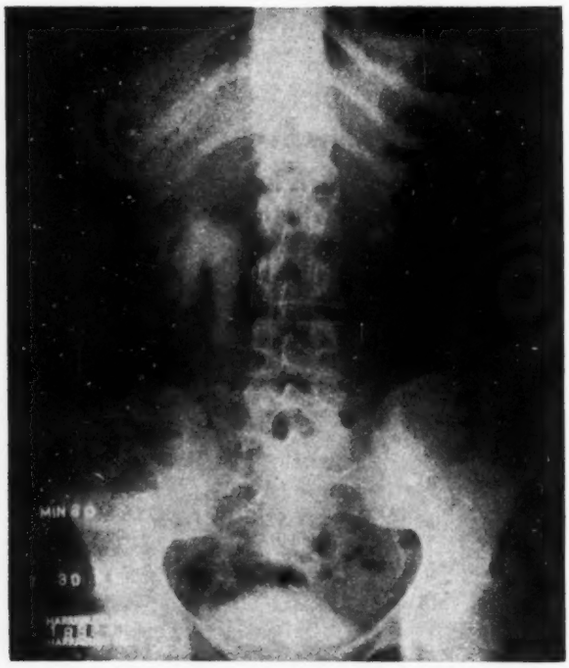

FIG. 1. Right preoperative intravenous urogram thirty minutes after injection of diodrast.

ureter assumes a normal caliber and course to the bladder. This imparts a so-called S curve or sickle-shaped appearance to the upper third of the ureter. In the lateral and oblique views the ureter embraces the vertebral column instead of falling away from it as it does normally.

The treatment of retrocaval ureter is surgical. The surgical policy, whether radical or conservative, is dictated by the degree of renal damage.

Division of the ureter, careful mobilization and disengagement from its retrocaval to an antecaval position, and anastomosis of the severed ends, with or without intubation, is the surgical technic employed to conserve renal function.

Various sites of ureteral division have been advocated, namely, above the ureteropelvic junction (Harrill); at the ureteropelvic junction (Derkes and Dial); immediately below the ureteropelvic junction (Kimbrough); at the point where the ureter passes retrocavally with excision of the involved portion (Goyanna, Cook, and Counseller); and finally at the ureterovesical junction (Lowsley). Cathroc recommends division of the inferior vena cava rather than ureteral division, particularly in cases where the opposite kidney is seriously damaged or destroyed.

CASE REPORT

D. A. (Harrisburg Hospital No. 28265A), a thirty year old, white woman, entered the Harrisburg Hospital on July 28, 1951, with a three-week history of intermittent, dull, right costovertebral angle pain which radiated to the right lower quadrant and was associated with nausea but no vomiting.

Positive findings on physical examination were paralysis of a vocal cord, right lower quadrant tenderness on deep palpation with moderate muscle guarding and right costovertebral angle tenderness. The blood pressure was 120/70, the pulse 80 and the temperature 98.6°F.

A voided specimen of urine revealed many pus cells and epithelial cells, 3 to 4 red blood cells high power field, a trace of albumin, a specific gravity of 1.020, and an acid reaction. A complete blood count showed 3,320,000 red blood cells, with a hemoglobin of 58 per cent and a white blood count of 3,050, with 68 per cent polymorphonuclears and 32 per cent lymphocytes. The blood urea nitrogen was 18 mg. per cent.

Intravenous urogram disclosed prompt excretion of radiopaque material from both kidneys. The left kidney was normal, but the right kidney showed marked hydronephrosis of the pelvis and calyces with kinking of the right ureter just below the ureteropelvic junction with mesial displacement. (Fig. 1.)

On cystoscopic examination the bladder was normal. Both ureteral orifices were small with the suggestion of a right ureterocele. A No. 5 ureteral catheter was passed up the right ureter to a point corresponding to the inferior margin of the body of the third lumbar vertebra where impassable obstruction was encountered. Bladder and right kidney urine specimens were clear, microscopic analyses were negative, and cultures were sterile in forty-eight hours.

Right retrograde pyeloureterography revealed hydronephrosis, with poor visualization of the upper third of the right ureter. The distal two thirds of the ureter was normal in caliber and course.

A diagnosis of ureteral obstruction due to an aberrant vessel or band at the ureteropelvic junction was made and the patient was subjected to surgery following correction of anemia.

The right kidney was exposed through the conventional lumbar approach. Without un-

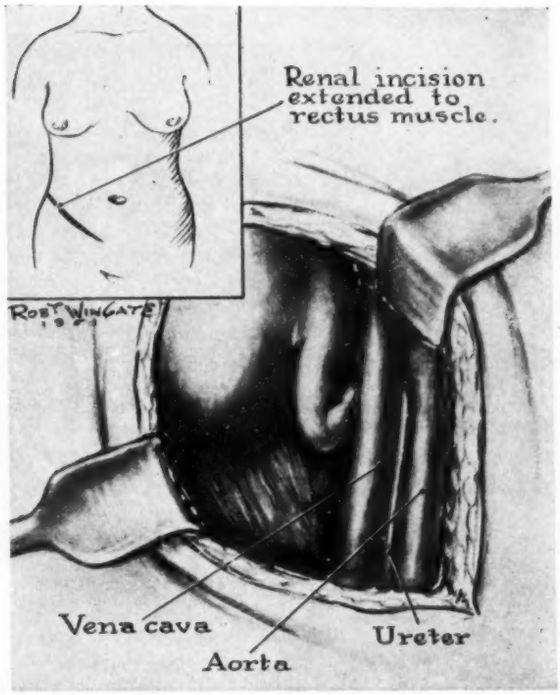

FIG. 2. Artist's concept of findings at operation.

FIG. 3. Postoperative ureteropyelogram, right oblique position.

duly mobilizing the kidney a large, dilated extrarenal pelvis and an elongated, tortuous and dilated proximal ureter were found. The ureter coursed somewhat cephalad and passed behind the vena cava. Further visualization of the ureter through the lumbar approach being unsatisfactory, the superior angle of the wound was closed and the patient placed in the supine position. The incision was then extended anteriorly, affording better exposure and the ureter, upon emerging from behind the vena cava, assumed a normal caliber and course to the bladder. After mobilizing the ureter carefully it was divided and placed anterior to the vena cava. A thickened and strictured portion measuring 2 cm. corresponding to the point of compression by the vena cava was excised. End-to-end anastomosis was accomplished over a No. 6 ureteral catheter using five interrupted sutures of No. 00000 chromic catgut. (Fig. 2.)

The catheter was passed to the bladder distally and brought out through the renal pelvis proximally, hence splinting the entire ureter. Pyelostomy drainage was established using a mushroom catheter.

The patient's postoperative course was uneventful and the ureteral splint was removed on the twentieth postoperative day. Upon clamping the pyelostomy tube the patient complained of pain and discomfort in the right costovertebral region.

Introduction of radiopaque material through the pyelostomy catheter on the twenty-second postoperative day showed marked dilatation of the pelvis and calyces and there was no evidence of dye in the ureter.

On the twenty-ninth postoperative day a No. 6 ureteral catheter was passed with ease to the right renal pelvis following a right ureteral meatotomy. Retrograde pyelography at this time showed a marked diminution of the previously described hydronephrosis. The ureter was patent. (Fig. 3.)

The apparent lack of ureteral patency one week previously was explained on the basis of the mushroom catheter blocking the ureteropelvic junction.

The patient was discharged from the hospital on the thirtieth postoperative day with instructions to clamp the drainage tube for increasing periods of time providing no untoward symptoms developed. Her convalescence at home was uneventful and she experienced no discomfort upon clamping the drainage tube for periods of five to six hours.

Two weeks later the patient re-entered the hospital for retrograde studies which revealed moderate hydronephrosis and patency of the

right ureter. The drainage tube was removed on the following day, with prompt closure of the sinus tract.

Periodic ureteral dilatations were carried out at three- to six-week intervals with the ureter accommodating a No. 10F bulb easily throughout its entire length.

Five months postoperatively the patient, symptom-free, was readmitted to the hospital for evaluation. Retrograde ureteropyelography revealed minimal hydronephrotic changes of the right kidney and patency of the ureter. Microscopic examination of the urine showed three to four pus cells and occasional squamous and renal epithelial cells. Cultures from the bladder and right kidney were sterile in forty-eight hours.

SUMMARY

A brief résumé of the history, embryologic considerations, statistical incidence, diagnostic features and treatment essentials of postcaval ureter has been presented.

An additional case, diagnosed at operation, with a successful plastic repair followed over an eight-month period is added to the series.

Transection of the ureter where it passes postcavally and excision of the postcaval segment with end-to-end anastomosis antecavally is advocated as the surgical treatment of choice.

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VAGINAL HYSTERECTOMY

A DESCRIPTION OF ITS ADVANTAGES, TECHNIC AND REVIEW OF 129 CASES

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NUMEROUS articles have appeared in the literature during the past ten to fifteen years indicating the great margin of safety which vaginal hysterectomy offers the patient. This method permits a decrease in operating time, shock, blood loss, postoperative infection, thrombophlebitis, embolism,[1] postoperative pneumonia and cardiac upsets. Numerous surveys have been made of cases collected from the literature and disclose a mortality rate of 0.18 per cent[2] to 0.31 per cent[3] for this operation. These figures in all likelihood are the lowest rate for any type of major surgery.

Vaginal hysterectomy can be performed alone or accompanied by any group of other gynecologic procedures. By this method the uterus and cervix are removed at once. The tubes and ovaries may also be removed when indicated. Vaginal repair may be added and a urethrocele, cystocele, rectocele and enterocele can all be corrected at the same time. Thus operation through the vaginal route is complete and leaves nothing undone. Partial operation such as a cervical amputation with repair leaves the fundus and adnexae. A rectocele repair and an abdominal panhysterectomy usually leaves an uncorrected cystocele. These conditions may require more surgery at a later date. Figures need not be quoted to indicate the large number of patients in whom tumors in the retained fundus develop. It is well to point out however that cancer develops in the retained cervical stump in about 5 per cent of cases.

The literature[4] abounds with references to the diabetic, cardiac, cardiorenal and debilitated patients who have received the benefits of this operation. Not as much can be said for the abdominal approach. It is certain that many patients with such medical complaints have not had the benefit of surgery because of the strain and shock[5] of the abdominal operation.

The method of vaginal panhysterectomy can generally be used whenever the abdominal approach would have been employed.[6–14] There are certain exceptions.

It is better to use the abdominal approach if the uterus is larger than a three months' pregnancy. There are some[15,16] who recommend morcellation of such a uterus prior to its removal through the vagina. This practice, obviously, is carried out by those surgeons well experienced in the vaginal approach.

The majority of gynecologists agree that carcinoma of the fundus should be treated abdominally. They also believe that cases of pelvic endometriosis or chronic pelvic inflammation can not be handled well vaginally. Previous suspension cases also fall into this category, unless the ligaments have become stretched and a certain amount of prolapse exists. Otherwise there seem to be no contraindications to this method.

The gynecologist faced with a decision as to the method to be employed in the correction of the various types of vaginal hernias, with or without prolapse, may choose any one of at least a dozen procedures.[17] When one considers vaginal hysterectomy and repair, it is apparent that an extensive combination of these procedures are employed at one time. There must be large numbers of women[18] throughout this country who have uncorrected severe lacerations of the vagina, accompanied with prolapse or procidentia of the uterus, enterocele and eversion of the vagina. I am convinced that vaginal hysterectomy and repair would reduce markedly the chronic pelvic complaints and the incidence of carcinoma if this method were employed more frequently.

It is not intended by any of the preceding remarks to recommend vaginal hysterectomy to the exclusion of the abdominal approach. It has already been pointed out when this method is preferable.

PREOPERATIVE INVESTIGATION

As in preparation for all other surgery the patient upon whom a vaginal hysterectomy is to be performed should be investigated preoperatively, since a large number of these operations are performed in the aged and on many others with chronic medical conditions.

In addition it is my custom for the patient with the "bald head" cystocele to be examined by the urologist. He evaluates the condition of the bladder, the presence of cystitis and by adequate washes and treatment will clear the infected urine from the bladder. He may not always accomplish this completely, but surgery is not performed until maximum improvement is obtained and his decision rendered. The importance of this type of treatment is that it reduces the incidence of cystitis postoperatively. It is a well known fact that a cystocele often contains a puddle of infected urine and that manipulation during repair will spread this into the rest of the bladder and thus cause severe postoperative cystitis.

In the series of cases reported in this article, two patients with severe mental depression were operated upon. Both had received electrical shock treatment during the year prior to operation. Each had a third degree prolapse or procidentia, accompanied with an extremely large cystocele and rectocele. In each instance the cystocele contained an abundance of urine and was so thick with pus that the urologist reported the urine as "resembling milk." These patients were treated by him for about three weeks preoperatively. Both patients were operated upon in the hope that correction of the organic disability and the removal of chronic infection would be of value to them. Each one showed improvement mentally immediately after the operation and continued to improve over a two-year follow-up period.

The infected vagina and cervix are treated preoperatively for at least three weeks. This treatment is carried on chiefly by the patient who is instructed to take 4-quart douches twice a day. The type of douche recommended is usually on an alternating basis. A douche, alkaline in nature, is taken in the morning and an acid douche at night. This method is employed as suggested in order to "buffalo the bug." In other words the environment is changed so frequently that the pathogenic bacteria present do not have the opportunity of accommodating themselves to it. This treatment is also carried out with the intention of irrigating the vagina, since in the face of infection it is considered "an abscess cavity." Reduction of the inflammatory congestion in the cervix and surrounding tissues improves these, with the result that the cervix does not bleed so readily when handled with instruments, nor will the catgut sutures necrose as quickly as they would in the presence of infection. Thus the hazard of sloughing of sutures and possible bleeding is reduced.

OPERATION

The method of performing vaginal hysterectomy has been well described by many writers.[12,16,19] Therefore, only some practical points seldom found in the literature will be discussed. The encircling incision made about the cervix is usually begun in the posterior portion and then carried around to the anterior aspect. The uterosacral ligaments often will present readily through the posterior incision. It is possible to clamp and suture tie them immediately without the interference of a bloody field, which otherwise would result from an anterior incision and the blood flowing downward. After the encircling incision has been completed, the bladder is freed from its attachments to the uterus and is dissected upward. If there is a question regarding the extent to which the prolapsed bladder is attached to the uterus, a catheter may be introduced into the cystocele and the position of it palpated over the surface of the uterus. Clamps are then applied to the bases of the cardinal ligaments and cut close to the uterus on each side. If the ligaments are well relaxed, then Kelly clamps are applied in short bites, continuing up one side to the level of the bladder reflection and the ligaments are cut close to the uterus. When the ligaments are not too well stretched, the clamps may be applied in short bites on each side, stepladder fashion, cutting between the uterus and the clamp. The Kelly clamp is used because a small bite can be taken with it and not too much tissue crushed. Ochsner clamps are never used because of the point in the tip of the clamp which may readily perforate vessels and cause bleeding. The bladder reflection is incised transversely when reached. Following the incision of this leaf of the peritoneum, the

uterus may be brought forward or tipped backward, depending on the easiest course. This in general will depend on the size of the uterus and the ease with which it can be delivered under the pubic arch. It may be easier at times to deliver the fundus directly through the vagina without tipping it or changing its direction at all. The clamps are removed from the cut edges of the ligament on each side after sutures have been applied and the various vessels tied. After removal of the uterus a pack is introduced into the pelvic cavity and the patient placed in deeper Trendelenburg position in order to keep the bowel away from the field of operation. The uterosacral ligaments are pulled forward with clamps held by the assistant. This permits the operator to palpate the ligaments on each side as far back as possible and under direct vision approximate both uterosacral ligaments by four or five interrupted sutures. The suture includes a portion of the posterior pelvic peritoneum, deep in the posterior cul-de-sac. If an enterocele is present, the hernia sac is pulled upward by a clamp applied in the "dimple" of the sac and two or three encircling sutures are placed across the nec to obliterate it completely. The neck of the sac is also included in the sutures which are used to approximate the uterosacral ligaments. This having been accomplished the anterior peritoneal bladder reflection is located. It is pulled down with clamps. This helps visualize the entire portion of the bladder making up the cystocele. The hernia is now freed from the posterior aspect of the anterior vaginal mucosa, separating the bladder from the mucous membrane and stretched fascia. The protruding bladder is reduced by means of one or two encircling purse-string sutures and thus returned as an abdominal organ. Interrupted sutures are used occasionally to reduce the mound of the cystocele and the fascia is frequently approximated by interrupted stitches.

After the bladder has been reduced and returned into the abdomen, the urethra is completely freed from its various adhesions to the pubic rami. Such adhesions may pull the urethra either to the right or left, or cause a shortening and bulging of the urethra and therefore must be separated. The urethra is completely exposed for its full length and almost for two-thirds of its circumference, leaving it attached only in the apex between the pubic rami. This dissection is exceedingly important, especially in cases of stress incontinence. It is the one step which appears to be common to the various operations which have been devised for stress incontinence. An examination of the description of such operative procedures shows that each operator who claims great success for his operation, whether his approach is abdominal or vaginal, actually does a very extensive dissection and breaking up of adhesions about the urethra.

The next step is the correction of the abnormal descent and abnormal movement forward of the urethra by placing sutures which will decrease the circumference of it. Plicating stitches are used and include as much of the urethral wall itself as possible. Following this, four or five sutures are placed so as to approximate the suburethral tissues. The suture picks up the tissue underneath one pubic ramus and is passed to the other side. These sutures when tied elevate the urethra. The caliber of the bladder neck is reduced by several sutures placed below it. The type of suturing described will produce a thick splint which in turn will help correct the stress incontinence, because of the elevation of the urethra.

Next the sponge is removed from the pelvic cavity and the count taken. The anterior and posterior pelvic peritoneal leaves are now approximated and peritonization is thus completely accomplished. The sutures originally placed through the stumps of the uterosacral ligaments having been left long purposely are now threaded on a needle and are sutured into the stumps of the lateral sets of ligaments. When these long sutures are tied, the stumps of the various ligaments are approximated to each other and to the uterosacral ligaments. Perforation of blood vessels is avoided since a needle does not have to be passed again through the uterosacral ligaments which were sutured together earlier in the operation. The mucous membrane is removed next from the anterior vaginal wall. The redundant portions are removed in the shape of a triangle. A "safety" stitch is introduced through the mucous membrane just behind the urethra and tied. This prevents tearing of the mucous membrane by unexpected pull. Interrupted sutures are then placed to approximate the cut edges of the mucous membrane. These begin just behind the urethra and are carried upward to that point which will become the apex of

the vagina. Here the cut edges of the anterior and posterior vaginal mucosa are approximated transversely in the same manner as in an abdominal panhysterectomy. The rectocele present is next repaired.

At the completion of the operation a pack is introduced into the vagina to produce pressure on superficial bleeders. This pack is permitted to remain in place for twenty-four to forty-eight hours, depending on the extent of the dissection carried out on the vaginal walls. At the termination of all procedures a catheter is introduced, generally of the Foley type, using a 3 or 5 cc. retaining bag. This is left open for constant drainage.

Criteria for a Good Result. The criteria for a good result are met if the patient has good urinary control, no discomfort during intercourse, good vaginal wall support with a vaginal apex pulled up high. Criticism has been leveled at vaginal hysterectomy because of the possible development of enterocele at a later time. When this occurs, it probably is always due to the fact that an enterocele was not recognized and repaired at the time of operation.

POSTOPERATIVE CARE

Postoperative care following vaginal hysterectomy usually is simple. The average patient is permitted out of bed by the fourth day, at which time she is instructed to sit in a chair only. This type of limited activity is continued until the sixth postoperative day at which time she is permitted about and is discharged on the seventh or eighth day. Instructions are issued at that time for her to continue at rest for at least a total of two weeks more. During the stay in the hospital and beginning as soon as possible after operation, the patient is on a full house diet and fluids are not limited in quantity. The self-retaining catheter is usually left in place for about three or four days at the end of which time it is removed. The average patient will void readily, but those who do not may require catheterization once or twice more and then will void satisfactorily. A few will still be unable to perform this function and if three catheterizations at six-hour intervals are required, then the catheter is replaced for twenty-four hours longer. Only a rare case will require the replacing of the catheter for a second time. The difficulty in voiding seems to be due to two reasons. It has been pointed out[20] that the fresh incision in the region of the urethra is almost always associated with spasm of the musculature, especially in sensitive individuals, and that in such individuals an inability to use the muscles of the pelvic floor develops postoperatively. The other reason seems to be that the bladder has learned how to function in its cystocele position and that after it is returned into the abdominal cavity it requires "education." This nerve muscle mechanism seems to vary in degree and seems unrelated to the amount of surgery performed. Explanation of this phenomenon will reassure the patient and make the waiting period easier for her.

The nerve muscle mechanism may be stimulated while the catheter is in place by clamping it shut for two hours and releasing it for the same period of time. The patient is instructed how to do this and continues this procedure for twenty-four to thirty-six hours prior to its removal. This procedure is effective in many cases.

There are some patients however who will still require assistance. In this group various medications and methods have been employed. Some have benefited from the introduction of 5 cc. 10 per cent argyrol solution or sterile mineral oil into the bladder. Either solution seems to overcome the dysuria and permits the patient to void without difficulty. In others intramuscular injections of doryl,* urecholine* or pituitary extract† will be beneficial. Considerable relief is obtained by some after sandalwood oil‡ 10 minims is given in capsule form at about four-hour intervals. True cystitis is proved by bacteriologic examinations and treated by daily irrigations and the various antibiotic or sulfa drugs, depending on the organism found.

Postoperative bleeding has offered no difficulty in the group of cases to be discussed later. In two cases only bleeding occurred on the eleventh day and was readily controlled by an oxycel pack placed into the apex of the vagina and held in this position by another

* Merck & Company: Doryl® (carbachol U.S.P.); urecholine® chloride (urethane of β-methylcholine chloride).

† Upjohn Company: pituitary extract (double strength U.S.P.).

‡ Eli Lilly & Company: santal oil® (elastic-filled capsules—East Indian); solution 'negatan' (negatol, Lilly)®.

pack. This postoperative complication is usually avoided by meticulous tying of the major blood vessels and veins with varicose enlargement and the insertion of a vaginal pack immediately after the operation. The pack produces pressure for twenty-four hours and this seems to be long enough to prevent oozing.

Vaginal discharge will develop in most of the patients about the seventh or eighth day. This is probably due to the quantity of suture material used and is readily controlled by douches.

Prior to discharge from the hospital patients are instructed to avoid spicy foods for several weeks. This seems valuable advice for all cases having had a catheter in the bladder. The patient is also instructed to avoid heavy lifting or prolonged standing for the first six weeks. This instruction is consistent with that given for all types of hernia operations.

The first examination following the convalescent period is performed about eight weeks after the operation. At this time residual catgut is removed and proliferating granulation areas are cauterized with negatan solution.* The patient is next seen about six weeks later. If at this time a piece of granulation tissue is found in the apex of the vagina, it is removed with a curet and the resultant raw surface is either cauterized with negatan solution or fulgurated. These procedures are painless.

GENERAL REVIEW OF 129 CASES

The following comprises a review of 129 vaginal hysterectomies of a much larger group. This number was taken because an adequate follow-up was obtained.

Symptoms. The symptoms presented by this group of patients were variable and gave no clue to the extent of the vaginal displacement. Some with lesser symptoms had the largest amount of vaginal disorder. For instance one patient who stated "that something hangs out of the vagina for the past twenty years" had a mass which measured eight inches from the urethra to the exposed cervical os and was 16½ inches in circumference. She stated that she had no other symptoms. This case was one of pelvic eventration. At operation it was found to contain the bladder, about 10 inches of rectum and sigmoid, the uterus and about 8 feet of small intestine.

Very few of the patients suffered pain and those who did usually translated it into a "bearing down" feeling or "pressure sensation." Obstruction to efforts in voiding was not accompanied by pain. In some women this function was accomplished after the cystocele was pushed back into the vagina.

Of this group there were two who had worn pessaries for two years, three for four years, one for nine years, one for ten years and one for nearly twenty-five consecutive years. In none of these did carcinoma of the cervix develop in spite of the use of a foreign body over such long periods of time.

Loss of urine curiously enough was complained of more often by patients who had a first degree prolapse. In this series there were thirty patients with second degree prolapse and thirty-seven with complete procidentia. Many of the latter did not complain of or suffer urinary loss on stress. This was probably due to the "knuckle"[21] formed in the urethra by the vaginal eversion and was sufficient to prevent such a symptom.

Not many patients complained of low abdominal pain in the group in whom enterocele was found. One might suspect that the reverse would have been true.

Vaginal bleeding at irregular intervals occurred only in forty-eight patients, most of whom had uterine fibroids.

Sixty-seven patients stated that the cervix frequently rubbed on their undergarments and yet there were no evidences of carcinoma of the cervix in any of these in spite of the fact that this condition had been present for many years.

Physical Examination. In addition to the usual physical examination if an enterocele was suspected, the patient was permitted to walk about and immediately re-examined. If a bulging mass was noted in the upper portion of the vagina, behind the cervix, enterocele was considered. Whenever possible, attempts were made to reduce the enterocele by introducing one finger in the rectum and one in the vagina and "milking" the mass upward. If the mass disappeared upward, a diagnosis of enterocele was made.

Statistical Facts. Table 1 outlines the ages and weights of patients upon whom vaginal hysterectomy was performed. It is significant

*Eli Lilly & Company: santal oil® (elastic-filled capsules—East Indian); solution 'negatan' (negatol, Lilly)®.

that over half of the patients were beyond fifty years of age. Five of this group were within the range of seventy-three years. Thirty-one patients weighed between 160 to 200 pounds and one was 230 pounds.

TABLE I
VAGINAL HYSTERECTOMY SURVEY OF 129 CASES

Age	No.	Weight (lb.)	No.
29–39	25	90–99	1
40–49	42	100–119	11
	Total: 67	120–139	35
50–59	44	140–159	50
60–69	13	160–179	20
70–73	5	180–199	11
	Total: 62	200–219	0
	Total: 129	220–239	1
			Total: 129

Included in this group were two patients who had suffered coronary disease, one who had had rheumatic heart disease and three who had active diabetes. Two others were suffering from active mental depression and both had had electrical shock treatment within recent months

TABLE II
OPERATIONS PRIOR TO VAGINAL HYSTERECTOMY

Procedure	No.
Vaginal operations (total 7)	
Vaginal plastic	4
Vaginal plastic and cervical amputation	1
Dilatation and curettage	2
Abdominal operations (total 32)	
Ovarian surgery	6
Cesarean operation	1
Cholecystectomy (and appendectomy in 3 cases)	10
Appendectomy	12
Hysterotomy for hydatiform mole	1
Uterine suspension	1
Myomectomy	1
Miscellaneous operations (total 5)	
Nephrectomy	1
Thyroidectomy	1
Saphenous vein ligation	1
Tumor of spine	1
Tumor of breast	1
Previous operations—total:	44

prior to the operation. Both of these cases had exceptionally large cystoceles with severe infection due to cystitis.

Spinal anesthesia was used in all cases discussed herein and transfusions were given only when indicated.

Table II demonstrates the fact that forty-four or about one-third of these patients had had previous surgery. Seven of these had vaginal operations and thirty-two abdominal surgery. Patients falling into the latter group readily acquiesced to operation when they were informed that the abdominal approach would not be necessary.

TABLE III
PROCEDURES PERFORMED IN ADDITION TO VAGINAL HYSTERECTOMY AND REPAIR OF VAGINAL WALLS

	No.
Bilateral vulvectomy	1
Excision of bartholin cyst	1
Rectovaginal fistula	1
Inclusion cyst of vagina	1
Diverticulum of urethra	2
Suture of bladder (entered during operation)	1
Enterocele repair	8
Left salpingo-oophorectomy	2
Bilateral salpingo-oophorectomy	1
Incision ovarian cyst	2
Resection of ovary	9
Oophorectomy	2
Removal of parovarian cysts	3
Pelvic eventration (with extensive hernia sac)	1

Table III indicates the surgery performed in addition to vaginal hysterectomy. Abnormal ovaries were removed without difficulty. The largest cystic ovary removed was nearly the size of a grapefruit. It was eased out of the pelvic cavity without rupture. The bladder was entered once in spite of cautious dissection. This was immediately recognized and repaired, and it offered no difficulty in healing. Eight enteroceles were repaired.

TABLE IV
SPECIFIC PATHOLOGY

Vagina	No.
Leukoplakia	1
Cervix	
Chronic cervicitis	Nearly all
Endocervical and endometrial polypi	23
Carcinoma *in situ* (cervix)	2
Leukoplakia of cervix	3
Keratosis of cervix	2
Hypertrophy of cervix	3
Fundus	
Atrophy or fibrosis uteri	27
Leiomyomas	48
Endometriosis or adenomyosis	12
Adenocarcinoma of fundus	1
Ovary	
Large simple cysts	5
Serous papillary cystadenoma	1
Adenocystoma	1

Table IV tabulates the pathologic disorder found at operation. It is interesting to note that in spite of long-standing severe cervicitis, wearing of pessaries and years of rubbing on

undergarments there were no external cancers of the cervix.[22] Two patients in whom carcinoma *in situ* was found are well two years after operation and one with unsuspected adenocarcinoma of the fundus is alive and well nine years after operation.

TABLE V
PATHOLOGIST'S REPORT

No. of Cases	Approximate Size of Uterus* (cm.)
3	10 × 8 × 4
2	11 × 7 × 5
6	12 × 6 × 5
5	13 × 8 × 5
1	14 × 8 × 7
1	16 × 8 × 6
1	17 × 10 × 8
1	19 × 10 × 12

* Normal size (average) is 8 cm. long by 5 cm. wide by 3 cm. deep; most cases about 8 by 5 by 3.5 cm.

Table v shows the pathologist's measurements of the largest uteri in this series. Leiomyomas were found in forty-eight cases. The largest uterus of all was involved with adenomyosis. It is worth while stating that none of these enlarged uteri required morcellation and were readily delivered by application in stepladder fashion of clamps to the ligaments with traction applied to the cervix until delivery was accomplished.

Immediate Postoperative Problems. In this series a small pelvic abscess developed in one case. It drained spontaneously on the thirteenth postoperative day and was completely cleared six days later. Twenty-one patients required further care before voiding satisfactorily after the catheter was removed. Seventeen patients suffered cystitis, ten of whom had had badly infected bladders prior to operation. Five patients remained in the hospital longer than ten days and were troubled with cystitis. One of these patients was not discharged until the twenty-first postoperative day. Two patients had some bleeding on the eleventh postoperative day which was readily controlled by means of an oxycel pack introduced into the vaginal apex. In thirty-two cases granulation tissue was removed from the vaginal apex as late as four months postoperatively.

Later Postoperative Problems. One patient, eighth in the series, required an enterocele repair operation approximately one year after vaginal hysterectomy. I believe that the enterocele was missed at the original operation, although it may have developed later. Ten days after the operation this patient went to work in a grocery store where she carried heavy loads and was on her feet fourteen to sixteen hours a day.

Large ovarian cysts developed in one patient and four years after vaginal hysterectomy she was operated upon for acute intra-abdominal bleeding from a ruptured large hemorrhagic lutein cyst. This patient was thirty-six years old at the time of the original opration.

Follow-up. The 129 cases discussed in the statistical tables were chosen from a larger group, because it was possible to obtain a satisfactory follow-up of these individuals. Two patients had died of medical causes many years after the operation but enough time had elapsed between the time of operation and last vaginal examination to indicate satisfactory results; 119 were personally examined; six replied by letter or telephone; and two patients last examined several years ago could not be located during this survey.

During the hospital stay or at any other time phlebitis or embolism did not develop in any of the patients and none suffered peritonitis, paralytic ileus or distention. Cardiac and diabetic patients were not disturbed by the operation and, as in the younger group, the aged withstood the operation without shock or difficulty.

The recent review disclosed the fact that the criteria for good results were met by this group and furthermore showed that many patients referred friends with similar trouble for care. In other words it may be assumed that as far as the patient is concerned the vaginal approach and results are most satisfactory.

SUMMARY

1. Vaginal hysterectomy is an operation which should be used more frequently than at present because the following can be accomplished at one time: complete removal of the uterus and cervix; cystocele, rectocele and enterocele repair; and if necessary the adnexae likewise can be removed.

2. It is not recommended that vaginal hysterectomy completely replace the abdominal approach. There are definite occasions when the latter must be used. To indicate the attitude of the author, the following figures are presented. During the period covered by the survey 265 total and 347 subtotal hyster-

ectomies were performed. In 461 of these cases some type of vaginal procedure was also performed at the time of the abdominal operation. The 129 vaginal hysterectomies reported herein and the number not surveyed were also performed during this same period. These figures are presented to indicate that the method is carefully chosen to suit the case.

3. Vaginal hysterectomy with or without vaginal plastic is an operation practically free of thrombosis, embolism, abdominal peritonitis or paralytic ileus.

CONCLUSION

As a result of this survey and the recommendations of others versed in vaginal hysterectomy the author believes that this operation should be employed oftener than it has been in the past. The chief reason being that by means of one operation complete gynecologic surgery is accomplished with a mortality rate from 0.18 per cent to 0.31 per cent. This probably represents the lowest mortality rate in any type of major surgery.

The current literature well demonstrates the fact that the vaginal approach to pelvic pathologic disorder has increased tremendously during the past ten years and that the criticism leveled at this operation is unjustified and usually comes from those not well acquainted with the procedure.

The method of vaginal hysterectomy and repair should be added to the armamentarium of the gynecologist because better results are obtained in the treatment of uterine prolapse and vaginal relaxations than by the abdominal route, accompanied by vaginal repair.

It is further recommended that efficiency in the vaginal approach for hysterectomy be as well developed as the abdominal approach so that the patient may receive the best results from modern surgery.

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NEOPLASMS OF THE SMALL BOWEL*

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NEOPLASMS of the small bowel, excluding the duodenum, are by no means common and it is rare for any one surgeon to have the opportunity of observing and treating more than a few instances of such tumors. At the Open Division of the Kings County Hospital there were 65,638 surgical admissions in the eleven-year period from 1941 to 1951. During this period eleven proven cases of neoplasms of the small bowel were observed and treated. At the same time 1,241 tumors of the large bowel were observed, all of which were malignant with the exception of seven.

Of approximately 50,000 admissions to the Marine Hospital, Baltimore and Norfolk, only four diagnoses of primary neoplasms of the small bowel were made. In our group of eleven cases we observed two types of tumors: benign and malignant, with the latter predominating.

The chief benign tumors seen in the small bowel are fibroma, fibromyoma, neurofibroma, lipoma, hemangioma, adenoma and endometriosis. We observed two cases of fibroma in our series and one leiomyoma.

It was noted that the size, location and behavior of the tumor determined the onset of symptoms. All varieties of intestinal obstruction were met: acute, subacute, chronic, acute exacerbation of a chronic obstruction, partial or complete, intermittent or progressive. Symptoms may be preceded by months or years of abdominal complaints of a vague or mild nature. A careful history was and is an essential, or course, for a diagnostic study. A most painstaking physical examination is also essential, including proctoscopy. Tumors of the small intestine may be palpable but in most instances in our series they were not. If on history-taking one is impressed with the symptom of continued blood loss without classical suggestions of peptic ulcer or bowel disturbance, one should think of the possibility of a small bowel tumor. Gastrointestinal bleeding and various manifestations of obstruction are the two important symptoms of small bowel tumors. Laboratory examinations including red cell counts and hemoglobin may indicate slow but progressive blood loss. Stool studies are also valuable if occult blood is present repeatedly.

The symptoms of benign and malignant growths do not differ greatly and even the duration of symptoms may prove misleading. In our group both sexes appeared to be involved and ages ranged from four years to eighty-three.

In many cases the diagnosis of tumor is made with difficulty. If the existence of this condition is kept in mind, a correct diagnosis can be made in a fair percentage of cases. Although obstruction was usually the clinical picture, it must be kept in mind, that a complication such as perforation and hemorrhage may be the first indication of the existence of the disease. These will be discussed in the cases to be reviewed. Roentgenograms are not as helpful in cases of tumor of the small bowel as they are in cases of tumor elsewhere because of the great length of the intestine and the difficulty of filling it homogeneously. However, the finding of dilatation, filling defects, indentations due to constriction or evidences of acute or chronic obstruction offers assistance. Negative results from x-ray studies do not rule out tumors of the small bowel, but positive results are of definite value. Special small bowel x-ray studies as modified by Schatzski shows much promise, as a special concentration of barium in water is injected into a Miller-Abbott tube when the tube is down to the point of suspected obstruction or at the terminal ileum. Other special methods have been developed by x-ray more in order to reduce the usual time required for a barium meal to pass the small bowel and films taken at short intervals. These methods are excellent and may result in a most accurate diagnosis of small bowel tumor if the diagnostician bears this condition in mind.

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In our group of cases there were four men and seven women. The youngest, as already stated, was four years of age and the oldest was eighty-three. In almost every instance pain was the dominant symptom. Eight patients presented the picture of obstruction, partial, progressive or complete. One had obstruction with perforation, two obstruction with hemorrhage and one hemorrhage alone.

Bleeding was present in the leiomyosarcomas and in one it was massive. Vomiting, which was usually recurrent, was a symptom complained of by all patients. Dehydration, alkalosis, hypochloremia and nitrogen retention occurred in those patients who had frequent vomiting. Tenderness, fullness and distention were findings on physical examination. An abdominal mass was palpable in three cases.

As pointed out previously, x-ray studies were not helpful in any of our cases. When complete or almost complete obstruction occurred, scout films of the abdomen did reveal distention and dilatation, as evidence of the obstruction.

Conditions that were considered in the differential diagnoses were: diverticulitis of sigmoid, appendicitis, ileitis, carcinoma of colon, bleeding ulcer and gallbladder disease. This was especially noted in two patients admitted with obvious peritonitis due to perforation as in one leiomyosarcoma and the leiomyoma.

Types of tumors encountered by us were divided as follows: fibroma, two cases; leiomyoma, one; leiomyosarcoma, two; argentaffinoma, one; adenomatous polyp with malignant degeneration, one; lymphosarcoma, two; and carcinoma, two.

Fibroma. This tumor is usually considered very rare. In our series one patient presented fifteen to twenty round, firm nodules in the jejunum and ileum, and the other presented a tumor the size of a grapefruit 30 inches distal to the ligament of Treitz, arising from the mesenteric border. These tumors arise from the subserous connective tissue or submucosa, probably through fibrous changes in preexisting myomas.

Leiomyoma. This tumor produced incarceration of the ileum with gangrene and perforation. It appears most frequently in the jejunum and least frequently in the ileum. These tumors have a tendency toward hemorrhagic degeneration. The patient was admitted in a very poor condition and did not have surgery. Autopsy revealed the aforementioned findings with hemorrhage into the tumor.

Leiomyosarcoma. This occurred in two patients, both of whom were women and over forty-five years of age. Obstruction, perforation and hemorrhage were all seen in one case and severe melena in the other. This latter case remained a problem in diagnosis for a long time, with repeated x-ray studies being negative. Only at operation was a tumor of the ileum found which proved to be a leiomyosarcoma. These tumors are well circumscribed, oval or lobulated. They project into the lumen and undergo either central ulceration or they infiltrate the entire wall. Histologically well differentiated cells, with prominent fibrils and a tendency to cause whorl formations are characteristic. The more rapidly growing tumors are composed of masses of large anaplastic cells.

Argentaffinoma. This was found in the ileum about 2 inches from the ileocecal junction and caused both obstruction and hemorrhage. These tumors are seen as clumps of spheroidal cells embedded in stroma of fibrous tissue. These tumors can be recognized with ordinary stains, but by specific methods the intracytoplasmic granules reveal affinity for silver.

Adenoma. Simple adenoma is considered to be a frequent tumor of the small bowel. It is often found in the ileum. In our series there was one patient, a fourteen year old boy, who had an adenomatous polyp which had undergone malignant degeneration. This boy had a small bowel resection in 1948 and has remained well. Adenomas of the small bowel arise from glandular elements in the bowel wall. They are usually single and small but sometimes they occur in great numbers. They grow intraluminally and a great many of them are polypoid in shape. Adenomas may produce symptoms of obstruction, hemorrhage or intussusception and assume great clinical significance. The tumor is composed of glandular acini and stroma of connective tissue.

Although there is considerable discussion as to the origin of the adenomas, whether they are the result of inflammatory changes or are primarily neoplastic, our case demonstrated histologically definite malignant changes in an adenomatous polyp. Polypoid types of ileal carcinoma may be considered arising in a degenerating adenomatous polyp.

Lymphosarcoma. This is a very frequent non-epithelial tumor of the small bowel and

arises from tissue potentially capable of producing lymphocytes. Both cases presented the clinical picture of obstruction and occurred in a child four years of age and a woman fifty-four. Both were found in the terminal portions of the ileum. The small bowel having extensive lymphatic development is peculiarly susceptible to this condition. Spreading beyond the regional lymph nodes is usually by the blood stream.

Lymphosarcoma may be primary or secondary. It usually starts in the lymphoid follicles but may arise independently. This tumor extends into and along the submucosa and muscularis mucosa, then into the mucosa and muscularis but rarely into the serosa. This results in a thinning of the wall with perforation, occasionally the end result.

Carcinoma. This occurred in two cases, one in the ileum and the other in the jejunum. The one in the ileum presented the typical picture of signet ring obstruction at the operation, but the patient was admitted to the hospital because of hemorrhage from the bowel. The other presented the clinical picture of progressive obstruction of the small bowel. Carcinoma of the small bowel may be either adenocarcinoma or medullary carcinoma. The growths are most often of the annular or constricting form but polypoid, ulcerative infiltrating growths are also seen. Adenocarcinoma is easily recognized microscopically by its atypical glandular formation and infiltrating malignant cells. Medullary carcinoma is highly malignant. Carcinoma of the small bowel may simulate a tuberculous lesion or vice versa. Ulceration and infection are frequent and in one case led to perforation and peritonitis six months after surgery was performed.

The small intestine is often involved in malignant tumors which may originate in the stomach, ovary, colon or other abdominal organs. This involvement may be by direct extension or by metastasis. We have not included these tumors in our discussion.

The treatment of tumors of the small bowel is, of course, surgical. In the majority of cases resection of the affected loop with end-to-end, end-to-side or side-to-side anastomosis is the procedure of choice. Local excision of the growth may be feasible in rare but selected situations. Early surgery will considerably lower the high mortality which exists with this condition if physicians and residents will continue to pay increasingly more attention to the small bowel.

SUMMARY

1. A review was made of eleven proven tumors of the small bowel at Kings County Hospital.

2. Symptoms and signs of small bowel tumors were discussed.

3. The pathology of each type has been defined.

4. Early recognition and treatment has been stressed.

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Case Reports

OSTEOCHONDROMA OF THE BRONCHUS*

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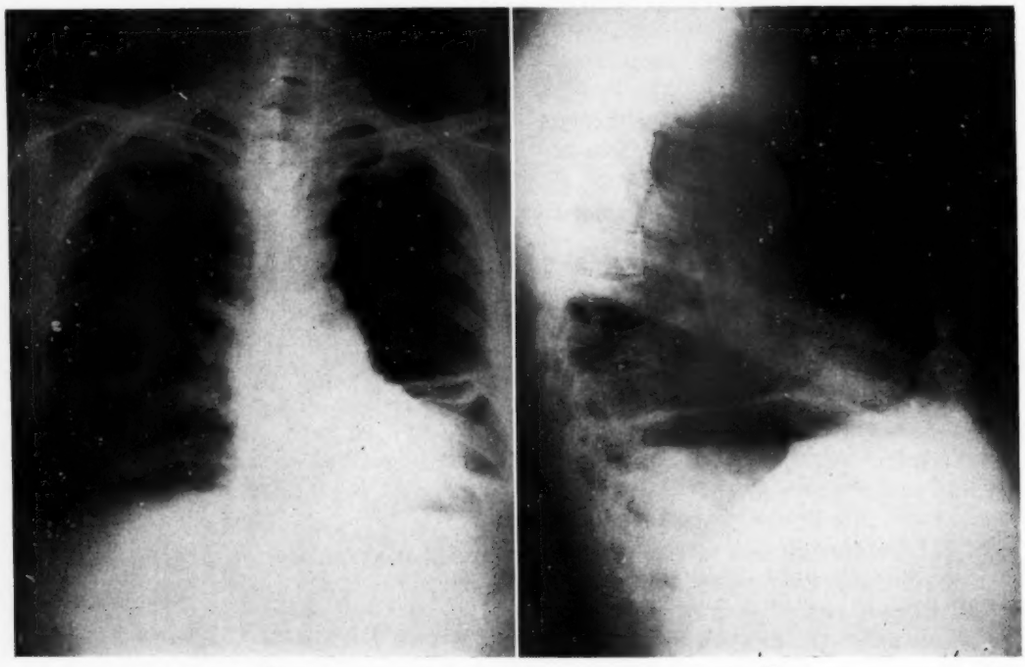
CARTILAGINOUS tumors of the lung are fairly frequently encountered at autopsy. They are usually peripherally located, are of hamartomatous nature and are not clinically significant. They may, however, attain large size and, as shown by Hickey and Simpson,[1] produce startling roentgenologic pictures. Cartilaginous tumors arising from the larger bronchi are of clinical importance because they give rise to signs and symptoms which may be easily interpreted as due to carcinoma but are amenable to curative surgical procedures. They are relatively rare, only twenty-three cases having been reported in the medical literature. Lindgren[2] collected eight cases and added one of his own. Postlethwaite and his co-workers[3] increased the number to fourteen. Terracol and others[4] added six from the literature and one of their own. Subsequently, Huet[5] and Rolland[6] have each reported one case.



1A 1B

FIG. 1. Preoperative roentgenograms. A, the postero-anterior view and B, the lateral view. These show asymmetry of the chest, density at the left base, atelectasis of the left lower lobe and elevation of the diaphragm.

The patient whose course is presented in the present communication illustrates many of the salient features demonstrated by this type of benign neoplasm.

CASE REPORT

The patient was a white man fifty-three years of age who had always used tobacco to

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FIG. 2. The cartilaginous polypoid mass (arrow) projects into the lumen of the lobar bronchus and caps the mouth of the medial basal segmental bronchus.

FIG. 3. The mass originates from a cartilage of the medial basal segmental bronchus.

excess, smoking about forty cigarettes daily, and had had a chronic non-productive cough for years. There was an equivocal history of bronchial asthma since early childhood. On one occasion, a year prior to coming under observation, he coughed up some "dark sputum." There had never been frank hemoptysis. During the winter of 1950–1951 he lost 20 pounds in weight.

The current illness began in February, 1951. Following exposure during a severe snowstorm while the patient was staying at a mountain resort in Europe, serohemorrhagic pleurisy developed from which he recovered in about four weeks. Following his return to the United States he regained about 16 pounds and was afebrile. He was very nervous but did not complain of fatigue. The sputum remained mucopurulent and occasionally was blood-streaked. Roentgenographic studies revealed a persistent, large, irregular mass of the left lower lobe close to the hilum. On bronchoscopy the left lower lobar bronchus was found partially obstructed by a papillomatous tumor mass. The impression of the bronchoscopist was that carcinoma was present; however, the biopsy was reported as papilloma. The patient's general condition was satisfactory, there was no further loss of weight and the laboratory findings were within normal limits.

He was admitted to the hospital on June 14, 1951, for exploratory operation. The lateral left lung base was dull, had bronchial breath sounds and was free of rales. There were no palpable lymph nodes in axillas or neck. The remainder of the physical examination and the laboratory results showed nothing of note. Roentgenograms revealed asymmetry of the chest; the left side was smaller. At the left base there was a density apparently due to fibrous thickening, atelectasis of the lower lobe and strands of density in the lower lung field. The left dome of the diaphragm was elevated and

FIG. 4. The tumor lies in the submucosa and shows fibroelastic cartilage, bone and fatty marrow. Small papillomatous projections arise from the surface epithelium. × 30.

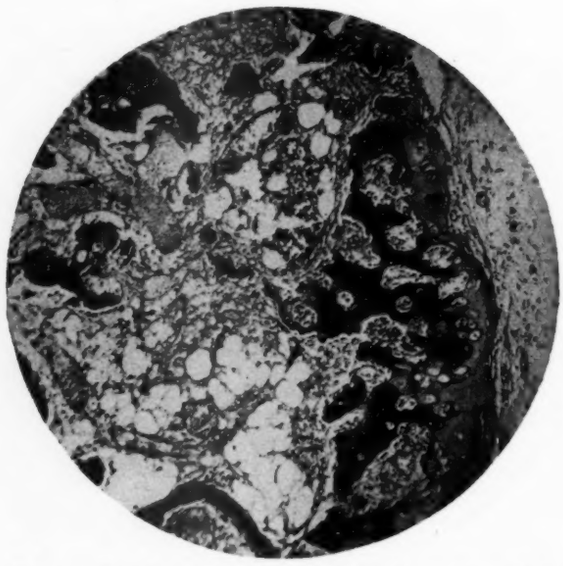

FIG. 5. Another area shows active bone formation, osteoblasts and functioning bone marrow. × 90.

there was a mediastinal shift to the same side. (Fig. 1.)

Pneumonectomy was performed on June 19th under endotracheal anesthesia using pentothal,® curare, cyclopropane, oxygen and ether. The pleural cavity was found obliterated by dense adhesions, those over the lower lobe being particularly dense and necessitating extrapleural separation from the chest wall. The lower lobe was atelectatic and small cavities were palpable within its parenchyma. In its hilum a hard mass 5 by 6 cm. in size could be felt. The hilar region was involved by massive adhesions encroaching on the vessels, obscuring the normal anatomic relations and causing some difficulty in identification of the structures. The left lung was resected after individual ligation of the pulmonary artery and veins. The bronchial stump was closed with atraumatic No. 00 chromic catgut and covered with pericardium and pleura. One gram of streptomycin and 300,000 units of penicillin were instilled.

The postoperative course was relatively uneventful. The patient was placed in an oxygen tent and given penicillin and streptomycin prophylactically. An irritant cough was controlled by the use of Stokes' expectorant and terpin hydrate elixir. During the first two weeks the patient's temperature ranged between 101° and 102°F. and fell to normal in the third week. The respirations gradually fell from 28 to 20 within two weeks. The pulse never rose above 90 and returned to 70 in two weeks. There was moderate anemia for one week (red blood cells 3,620,000, hemoglobin 68 per cent) which quickly disappeared, returning to normal in two weeks. The patient was discharged on the twenty-fifth day in good general condition with minimal exertional distress.

The pathologic report was as follows: The left lung measured 17 by 13.5 by 4 cm. The visceral pleura had numerous fibrous bands and attached portions of the parietal pleura. The interlobar fissure was obliterated by fibrosis. The lower lobe felt solid. The lower lobar bronchus was dilated and the mucosa was moderately injected. Capping the mouth of the medial basal segmental bronchus, there was a hard cartilaginous mass which obstructed the lumen. (Fig. 2.) All the segmental branches were markedly dilated and filled with pus. Scattered throughout the entire lobe were numerous purulent cavities, most of which communicated with the bronchial tree. The intervening parenchyma was solid and non-air containing. There was a separate small mass similar in consistency to the tumor of the segmental bronchus. The upper lobe appeared normal. There was a small separate segment of main bronchus.

Microscopically, the tumor mass arose from a cartilage of the medial basal segmental

bronchus and lay in the mucosa. (Figs. 3 and 4.) It consisted mainly of fibroelastic cartilage with numerous areas of true bone formation. (Fig. 5.) The bone had marrow spaces containing fat, some delicate connective tissue with thin-walled capillaries and small nests of functioning bone marrow. Some of the small marrow spaces had a rim of osteoblasts. The separate mass was of similar nature and was covered with a thin epithelium predominantly of squamous type. There were a few small papillomatous outgrowths whose epithelium was similar. Distal to the mass the bronchi were dilated and lined by normal respiratory epithelium. The mucosa was heavily infiltrated with lymphocytes and plasmacytes. In some areas the walls of the smaller bronchi were destroyed by inflammatory exudate and the resulting cavities were filled with pus. Many parts of the parenchyma were fibrosed and infiltrated with inflammatory cells. Some areas had small groups of compressed alveoli filled with purulent exudate or with lipid-bearing cells producing the picture of lipoid pneumonia. The bronchopulmonary lymph nodes had follicular hyperplasia and moderately abundant carbon. The upper lobe and the segment of main bronchus were normal.

Diagnoses: osteochondroma of medial basal segmental bronchus of left lower lobe; chronic bronchiectasis of left lower lobe.

COMMENT

The clinical course manifested by these tumors is usually one of unilateral pulmonary infections accompanied by severe cough, recurring over a long period of time. Many of the reported cases had episodes of illness for ten to twenty-five years. The cough sometimes has been so violent as to suggest the presence of a foreign body. Weight loss, when it occurs, is a late manifestation. The sputum may or may not be abundant and mucopurulent; sometimes it is blood-streaked. The present patient had an unusually short course of four months, although the rather obscure history of "dark sputum" a year previously may be of some significance. The short course can be attributed to the present day routine use of roentgenology as a diagnostic procedure and the fact that thoracic surgery is not now the formidable procedure it was a few years ago. Although lobectomy is preferable if the lesion is recognized as benign before or during operation, it is doubtful if it was feasible in the present instance because of the location of the tumor close to the main bronchus and the massive adhesions produced by the previous inflammatory disease. Sometimes these tumors have been successfully removed through the bronchoscope. As far as is known, none has ever proven malignant.

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PRIMARY CARCINOMA OF THE INFRAPAPILLARY PORTION OF THE DUODENUM*

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CARCINOMA of the infrapapillary portion of the duodenum is encountered infrequently. However, it is a condition which can be diagnosed preoperatively and which is subject to surgical treatment. Up until 1950 Shallow and associates[1] could collect only fifteen cases from the literature in which resection was performed.

We have recently encountered a patient in whom this lesion was diagnosed preoperatively and in whom a resection and primary end-to-end anastomosis was performed.

CASE REPORT

M. T., a forty-one year old white woman, was admitted to Mount Sinai Hospital on September 29, 1950, because of weight loss and easy fatigue. She had been told she was anemic in 1942. In March, 1949, she noticed that she tired easily and was found to have a low hemoglobin. She received iron and liver therapy and her condition improved. In May, 1950, there was a recurrence of symptoms but hematinics had little effect. An upper gastrointestinal x-ray in August, 1950, was reported as negative. From this time until hospitalization (six weeks) she lost 17 pounds. She had noticed exertional dyspnea and palpitation since the onset of her illness (March, 1949). Through all this her appetite remained good and she did not ascribe her weight loss to any decrease in eating. In October, 1949, she had an attack of right upper quadrant abdominal pain with nausea, vomiting and jaundice, but no change in the color of her stools.

At the time of hospital admission physical examination revealed a thin, pale woman with a normal blood pressure, temperature, pulse and respiration. There was a suggestion of a left upper quadrant mass and a questionably palpable liver. Otherwise the examination was negative.

Hemoglobin was 9.7 gm. with 8.2 per cent reticulocytes and 5,750 leukocytes with a normal differential. Urinalysis was normal. Serum bilirubin, total protein and A/G ratio, cephalin flocculation, thymol turbidity, prothrombin time and bromsulfalein excretion were within normal limits. Blood sugar, blood urea nitrogen, sedimentation rate and red cell fragility were normal. Coombs' test was negative. The stool on three different examinations for occult blood was 4 plus.

Proctosigmoidoscopy and barium enema were negative. An upper gastrointestinal x-ray revealed a "large intra-luminal lesion at the duodeno-jejunal junction which is almost certainly due to neoplasm." There was no obstruction.

Laparotomy was performed on October 16, 1950, through an upper left rectus incision. A bulky intraluminal mass was felt in the distal duodenum extending beyond the ligament of Treitz. The liver contained no nodules. The spleen was slightly enlarged. There were no palpable lymph nodes. The lesser peritoneal sac was entered through the gastrocolic ligament. The peritoneum lateral to the duodenum was incised to permit its mobilization. The duodenum was divided just distal to the entrance of the common duct. The duodenum was separated from the superior mesenteric vessels and the ligament of Treitz was cut. The vessels to the third and fourth portions of the duodenum and the proximal jejunum were clamped, cut and ligated. The jejunum was divided about 10 cm. beyond the ligament of Treitz. An end-to-end anastomosis was then made anterior to the superior mesenteric vessels. The rent in the mesocolon was closed and the abdomen was closed without drainage.

The pathologic report was as follows: The specimen consisted of 15.5 cm. of small bowel containing a fungating lesion 7.5 cm. long. The serosa overlying the lesion was puckered. Three lymph nodes were present, the largest measuring 1 cm. in diameter.

Microscopic examination revealed a moder-

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ately malignant adenocarcinoma extending into the muscularis with lymph node metastases.

The postoperative course was uneventful and the patient was discharged on the thirteenth day after operation. Immediately after discharge she did fairly well but some backache soon developed and she became bloated after eating. In May, 1951, she again complained of weakness and anorexia. On June 2, 1951, seven and a half months after operation, she expired in her sleep. Autopsy was not obtained.

COMMENTS

The incidence of primary carcinoma of the duodenum is low. On the basis of autopsy studies Eger[2] gave it as 0.033 per cent and Howard[3] reported it as .047 per cent. Both of these studies found a minority of the lesions in the infrapapillary portion. In spite of its rarity this lesion should be diagnosed preoperatively. The clinical picture usually is that of a high intestinal obstruction, partial or complete. However, in our patient the bowel was studied in an attempt to explain a persistent anemia rather than because of any gastrointestinal symptoms. Careful x-ray studies will reveal the site of the lesion. That the diagnosis can be correctly made was pointed out by Weber and Kirklin,[4] and Shallow and associates.[1] Both of these groups noted a correct diagnosis by x-ray in all carcinomas encountered in the third portion of the duodenum.

Despite the absence of any gross metastases or extension the lymph nodes removed with the specimen were involved and the survival was relatively short. Obvious extension into the pancreas would necessitate pancreaticoduodenectomy for cure and we wonder if our patient would have benefited by such a procedure. In addition to the wider local resection this would permit complete removal of the lymph nodes and vessels around the superior mesenteric and portal vessels and celiac axis.

SUMMARY

1. A case of primary carcinoma of the third portion of the duodenum treated with segmental resection is reported.

2. It is suggested that treatment of this lesion by radical pancreaticoduodenectomy would be more in keeping with the current concept of cancer surgery.

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GRANULAR CELL MYOBLASTOMA OF MULTICENTRIC ORIGIN*

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IN 1949 Murphy, Dockerty and Broders in a comprehensive review of the literature, employing specified criteria, reported a total of 219 accepted cases of myoblastoma and added ten cases of their own. Since then several cases have been reported, bringing the total to nearly 300.[1,2,5,9] In 1934 Klemperer reported six cases.[12] Of these, Case 2 was one in which two tumors were concurrently present, one in the skin of the left lateral region of the abdomen and the second in the skin of the suprapubic region. The intervening period has seen no additional reports of multiple benign myoblastomas. It is believed that the present case is the second such case to be reported. Moreover, the contralateral locations involved emphasize the multicentric origins of the neoplasms.

CASE REPORT

On August 8, 1950, a thirty-eight year old Negro woman was admitted to Sydenham Hospital with a history of noticing a "tumor" in the region of the lower abdomen. For approximately a year previously the patient had noticed a lengthening of her menstrual periods from a duration of four to eight days.

Past history disclosed that the patient had had a "tumor" removed from the left axilla in 1942. The nature of this lesion could not be ascertained.

Physical examination of the abdomen revealed a large, smooth, firm tumor rising out of the pelvis reaching to the umbilicus. On pelvic examination a preoperative diagnosis of multiple myomas of the uterus was made. On examination of the skin and subcutaneous tissues three small, firm, movable tumors were found under the skin. The first of these was located in the left anterior axillary wall and was 3 to 4 cm. in diameter. The overlying skin was reddened. The second was approximately of the same size and situated along the right anterior axillary line at the level of the fifth intercostal space encroaching on the outer border of the breast. A third enlargement was reported as consisting of a small firm tumor, palpable in the right axilla, but was thought to be a lymph node.

Laboratory data were as follows: hemoglobin 12.5 gm. per 100 cc.; red blood cells 4,100,000 per cu. mm.; white blood cells 11,800 per cu. mm. Differential smear: polymorphonuclear leukocytes 58 per cent, transitional cells 12 per cent, lymphocytes 27 per cent, eosinophils 3 per cent. On urinalysis examination a trace of albumin was found.

At laparotomy it was noticed that the pelvis was filled with fibrous adhesions, and the right ovary was cystic and enlarged. Subserous and intramural myomas of the uterus were present. Hysterectomy and right oophorectomy were performed. Following this the subcutaneous tumors in the left anterior axillary wall and right chest wall were removed. Both of these were thought to be fibromas at operation. The postoperative course was uneventful and the patient left the hospital eight days following operation. It was not possible to obtain a follow-up study on this patient.

The pathologic description is confined to the subcutaneous nodules that were removed. Grossly the specimen removed from the right chest consisted of two portions of white "fibrous tissue," both irregular in shape. The larger portion measured 3 cm. in the direction of its longest diameter and the smaller, approximately 1.5 cm. It was remarked that this tissue had the gross appearance of a fibroma.

The tumor removed from the left anterior axillary wall was a somewhat oval-shaped mass measuring 4 by 3.5 by 2 cm. One surface was covered by skin containing a sparse distribution of hair. The mass was of firm consistency, and its cut surface was white and presented a whorl-like pattern. A thin capsule was described

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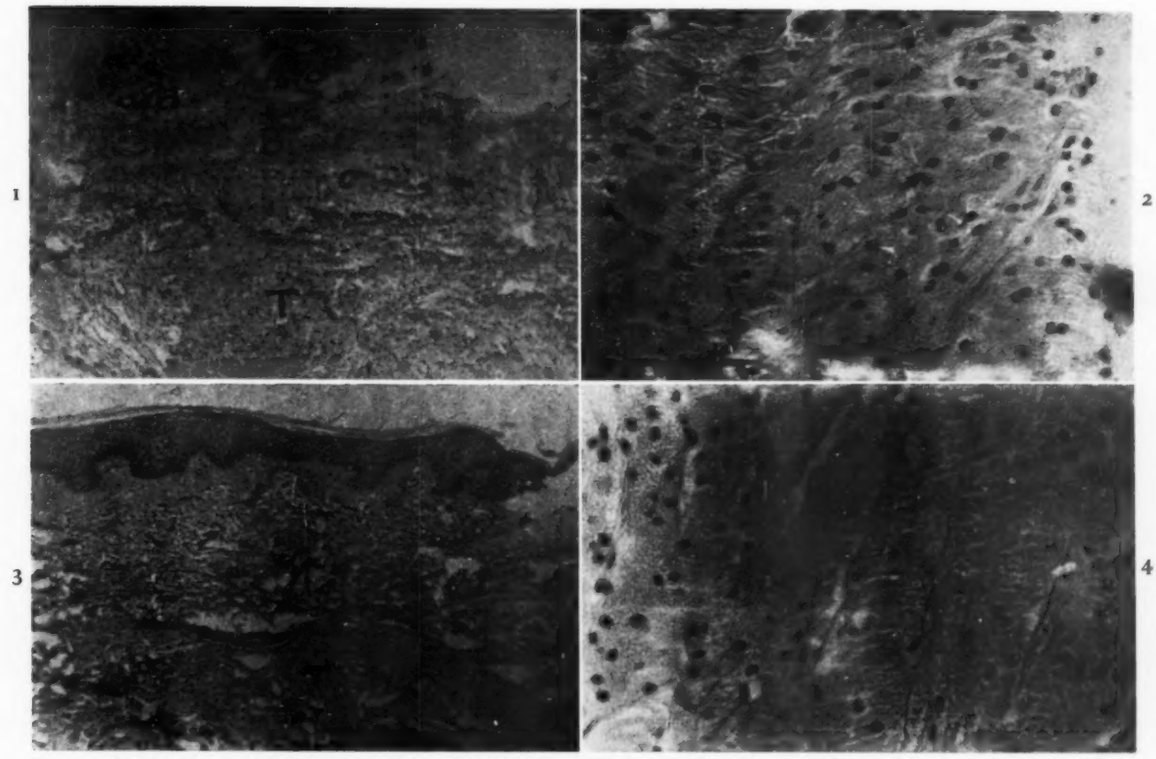

FIG. 1. Section from right anterior chest wall. Tumor (T) seen below encroaching upon normal breast tissue (B). Hematoxylin and eosin, × 90.

FIG. 2. High magnification of tumor in right chest wall. Hematoxylin and eosin, × 360.

FIG. 3. Section from left anterior axillary wall. Overlying epithelium slightly atrophic. Tumor in lower central portion of photograph extending into corium from below. The cyst-like spaces are artifactual. Hematoxylin and eosin, × 90.

FIG. 4. High magnification of Figure 3. Note granularity of cytoplasm and similarity to Figure 2.

investing the periphery. It was remarked that this tumor also had the gross appearance of a fibroma.

Microscopically the sections of the specimen removed from the right chest wall revealed the presence of a tumor mass encroaching upon essentially normal breast tissue. (Fig. 1.) No invasive properties were demonstrated and the entire mass was composed of cells proliferating in a somewhat orderly fashion. For the most part the tumor was composed of compact bundles of cells which were polyhedral or oval in shape, with deep-staining round or oval nuclei. The cytoplasm stained intensely eosinophilic and appeared granular. (Fig. 2.) The cell bundles were frequently syncytial in structure and separated from each other by fine strands of collagen in which fibroblasts were occasionally seen.

Fat stains were negative. With van Gieson's stain the cell bundles stained orange-yellow whereas the intercellular connective tissue strands were deep crimson.

The sections of the specimen removed from the axillary wall of the contralateral side exhibited a neoplastic proliferation of cells pushing into but not invading the subcutaneous tissue from below. (Fig. 3.) The overlying epithelium disclosed a very slight degree of atrophy but otherwise was unremarkable. High magnification examination of the cells revealed an appearance altogether similar to that of the tumor in the right chest wall. (Fig. 4.)

In both specimens the diagnosis was compatible with that of the uniform type of granular cell "myoblastoma."

COMMENTS

The histologic classification of these tumors has undergone metamorphosis since Abrikossoff's original description of four groups[3] to the classification into two histologic groups as

noted in the article by Murphy, Dockerty and Broders.[2] In accordance with the latter the present case is compatible with the uniform type as distinguished from the pleomorphic type.

The localization of the tumor is diverse and apparently may be encountered in almost any part of the body. It has appeared in as widely scattered areas as the bronchus and urinary bladder.[6,7]

The degree of malignancy has been estimated to be in the neighborhood of 11 per cent.[10] Such tumors are considered to be rhabdomyosarcomas and may undergo metastasis. Histologically these are usually of the pleomorphic type.

Shortly after the tumor was given notice by Abrikossoff, the view was expressed that myoblastomas were tumors which were basically rhabdomyomas in an early stage of development.[8] Since then there has been much speculation about the nature of this tumor, whether it is myomatous in origin or not.[5] Recent histochemical analysis indicates that these tumors may be fibroblastic in origin rather than myoblastic.[4]

Opinion is still somewhat divided as to whether myoblastoma is a true neoplasm,[5] or whether it represents a degenerative change. The present case of multiple myoblastomas may fit equally well into either of these two views.

The unusual feature of the case presented in this article is the multicentric origin of the tumor. The report by Klemperer together with the present one reveals that myoblastoma has in common with other tumors the feature of multiplicity. The eighteen-year lapse in time together with the frequency of two cases in 300, or approximately 0.7 per cent, shows however that such an occurrence is rare. The two tumors, the one removed from the right anterior chest wall and the other from the left anterior axillary fold, while contralaterally disposed are alike in their histology. The possibility of monocentric origin followed by contralateral metastasis of a malignant neoplasm is unlikely on the grounds of the benign cytologic appearance of both tumors, although at least one observer has reported metastasis from a lesion of this type.[11] A reasonable assumption is that each tumor arose independently from the subcutaneous tissues of its respective side. The patient was not aware of a time relationship in the appearance of the two masses and a chronologic sequence for the appearance of one of the tumors before the other could not be established. However, it would seem that such a sequence is more probable than the simultaneous origin of both neoplasms.

It is moreover noteworthy that a third tumor was removed from the left axilla eight years before the present admission. Information as to the nature of this lesion was not obtainable, but speculation based on the present findings suggests that this too may have been a myoblastoma. The small firm tumor described in the right axilla was not removed at operation, but was thought to be a lymph node.

SUMMARY

The second case of granular cell myoblastoma of multicentric origin is reported. The time lapse between reports is eighteen years.

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PERFORATION OF CHRONIC DUODENAL ULCER DURING CORTISONE THERAPY FOR ADDISON'S DISEASE*

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A NUMBER of reports have appeared regarding perforation, reactivation or massive hemorrhage from peptic ulcers in patients on prolonged therapy with corticotropin or cortisone. Habif, Hare and Glaser[1] report a case of perforation of a duodenal ulcer in a patient receiving ACTH for amyotrophic lateral sclerosis. Beck et al.[2] report a similar complication in a patient with periarteritis nodosa being treated with ACTH. Hollander[3] comments on peptic ulcer perforation in two patients receiving ACTH. Thorn et al.[4] emphasize failure of healing of peptic ulcers in patients treated with ACTH and record several examples in which ulcer symptoms have been aggravated during ACTH administration. Sloan, Briggs and Halsted[5] describe a patient with a past history of duodenal ulcer which perforated while the patient was being treated for chronic ulcerative colitis with ACTH. Lubin et al.[6] report two cases of patients with acute duodenal ulcers while on ACTH and cortisone therapy.

In addition to the foregoing several authors have emphasized the masking of the usual symptoms associated with activation and perforation of a peptic ulcer and the ensuing peritonitis. Habif et al.[1] describe a feeling of well-being in their patient with a lack of febrile response following perforation, in spite of peritonitis and a board-like abdomen. Beck et al.[2] report two cases of generalized peritonitis with marked deviation from the usual clinical course. Lubin et al.[6] state that in one of their patients who had perforation and peritonitis there was absence of leukocytosis, a delayed and minimal febrile response, and an apparent delay in the findings associated with generalized peritonitis.

Many studies have emphasized the delay in the development of all elements of connective tissue in animals and humans receiving ACTH and cortisone. This has also been noted in the presence of suppurative processes and in the failure of wound healing. Lubin et al.[6] point out that such phenomena were demonstrated in one of their patients with perforation in whom localization and sealing of the perforation were not observed at surgery.

The mechanisms involved in the foregoing have been investigated by Gray et al.[7,8] They have demonstrated a marked increase in the basal and nocturnal gastric secretion of hydrochloric acid and pepsin in subjects receiving ACTH. The maximum effects were noted after seven to fourteen days of continuous corticotropin administration. This coincides with the usual duration of ACTH or cortisone therapy which precedes reactivation, perforation or hemorrhage from peptic ulcer.

The purpose of this article is to describe a patient who demonstrated the above phenomena and required surgical closure of an acute perforation of a pre-existent duodenal ulcer, while on cortisone therapy for Addison's disease.

CASE REPORT

C. B., a forty-seven year old white woman, was admitted to the Welborn Memorial Baptist Hospital on June 14, 1951, complaining of profound weakness. She denied having pain of any kind and there were no gastrointestinal symptoms. The diagnosis of Addison's disease had been previously established by one of us (A. H. G.) late in 1949. Previous therapy had consisted of intramuscular desoxycorticosterone acetate in oil, and later implantation of desoxycorticosterone acetate pellets subcutaneously. Past history revealed the following: (1) old inactive minimal pulmonary tuberculosis of many years standing; (2) peptic ulcer symptoms of twenty years' duration proven by upper gastrointestinal x-rays to be duodenal ulcer on several occasions over the previous fifteen-year period; (3) known chronic cholecystitis with cholelithiasis of at least

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fifteen years' duration; (4) long-standing right hydronephrosis with recurrent right pyelonephritis; (5) recurrent difficulties with relaxed pelvic floor, with cystocele, rectocele and procidentia uteri, for which several surgical procedures had been performed; (6) long-standing normocytic, normochromic anemia of moderate severity.

Physical examination on admission revealed an emaciated, darkly pigmented white woman who appeared acutely and chronically ill. Patchy pigmentation of the oral mucous membrane was present. Oral temperature was 97.6°F. and the blood pressure was 60/40, right arm recumbent. The lungs were clear to auscultation and percussion. The heart was small with a normal sinus rhythm, and faint muffled heart sounds were present at a rate of 80 beats per minute. The abdomen was scaphoid, soft and non-tender. There were no masses or rigidity present. The liver, spleen and kidneys were not palpable. No local or generalized lymphadenopathy was present. Hyporeflexia was present throughout. Routine urine examination was negative except for 30 to 40 white blood cells per high-powered field. Blood examination revealed a moderate normocytic normochromic type of anemia. The white blood cell count and differential count were within normal limits.

In view of the proven diagnosis of Addison's disease in this patient it was believed that the clinical picture at the time of admission was that of Addison's disease with crisis, so intensive therapy was begun. During the first hospital day this consisted primarily of intravenous glucose and saline together with massive parenteral administration of intramuscular and intravenous aqueous adrenal cortex extract and intramuscular DOCA. On this program the clinical picture remained totally unimproved and the patient remained extremely hypotensive, with an average systolic blood pressure of plus/minus 60 to 80 mm. of mercury. Because of failure to improve it was decided twenty-four hours after admission to continue with the aforementioned therapy, but in addition to add cortisone intramuscularly to the therapeutic program. Cortisone was given in a dose of 100 mg. intramuscularly every eight hours, beginning on the second hospital day. This was continued over an eleven-day period. Because of the persistence of severe hypotension additional cortisone was begun by the oral route on the seventh hospital day, giving 100 mg. by mouth daily, in four divided doses. A total of 3,900 mg. of cortisone had been administered to the patient up to and including the twelfth hospital day. On the large dosage program of cortisone there was a striking and rapid clinical improvement and the systolic blood pressure rose to plus/minus 100 mm. of mercury.

On the twelfth day after the initiation of cortisone therapy the patient began to complain around 8 A.M. of rather vague discomfort across the entire upper abdomen. Other than this she felt "the best I have in days." Examination of the abdomen at that time revealed a slightly rigid upper abdomen with only mild tenderness. During that same day the patient refused to eat. By 4 P.M. she had fairly severe generalized abdominal discomfort but still insisted that she felt well. Temperature, pulse, respirations and blood pressure remained normal. Abdominal examination at that time revealed a rather rigid abdominal wall throughout, with only moderate tenderness to deep palpation. The patient was still afebrile. Due to lack of the usual signs and symptoms perforation of a viscus was not seriously considered. At 11 P.M., because of abdominal pain, examination by one of us again revealed a firm but not board-like abdomen. There was no fever. Peristaltic sounds were absent. At no time was there tympany in the hepatic area. It was believed that the patient had a perforated viscus, probably from the site of her previously known duodenal ulcer, with peritonitis. Abdominal laparotomy was performed.

Exploration was performed, using intratracheal gas-oxygen-ether anesthesia after a Levin tube had been placed in the stomach through an upper midline incision. As the abdomen was entered, free air exuded from the peritoneal cavity. Approximately 1 L. of thin fluid was removed by aspiration. On the anterior wall of the duodenum there was a perforation of a duodenal ulcer which measured approximately 4 by 5 mm. in size. There was no fibrin response and no evidence of sealing of the perforation was visible. The aperture was closed by interrupted sutures of fine catgut and the anterior wall of the pylorus was rolled over the defect and sutured with interrupted cotton. The abdomen was closed without drainage with interrupted cotton sutures. The

patient received 500 cc. of whole bank blood during surgery.

Postoperatively, cortisone was discontinued and the patient was maintained with all of the usual therapy for Addison's disease, with the addition of a progressive Sippy dietary regimen for the duodenal ulcer, together with the usual antispasmodics, alkalinizing agents, sedatives and the like. On this program she made an uneventful postoperative recovery as far as the perforated duodenal ulcer was concerned. The Addison's disease, postoperatively, has followed an indifferent course and has required re-implantation of DOCA pellets on two occasions. The patient has been carefully followed for seven months subsequent to discharge from the hospital. During this period, she has had no definite duodenal ulcer symptoms and there have been no further ulcer complications.

COMMENT

This patient illustrates several points of interest emphasized in various reports in the literature which have been cited. First, an acute perforation of a pre-existent chronic duodenal ulcer developed while the patient was on intensive prolonged cortisone therapy. This occurred on the twelfth day after cortisone treatment was initiated. This time element coincides with that reported in the cases previously referred to herein. Second, phenomena which others have described were demonstrated, namely, masking of the usual symptomatology and clinical picture of perforation and peritonitis. Third, the patient demonstrated a complete lack of connective tissue reaction with the perforation. There was no evidence whatsoever at the time of surgery of any sealing or walling off process about the perforation. This is in agreement with the observation of several authors and is attributable to cortisone administration.

SUMMARY

A patient with Addison's disease in crisis, and with pre-existent chronic duodenal ulcer, developed an acute free perforation of the duodenal ulcer while being treated with cortisone.

The authors agree with the observations of others who have advised that ACTH and cortisone should be used with caution, or not at all, in patients who have or have had a peptic ulcer.

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PENETRATING WOUND OF THE LIVER*

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PENETRATING injury of the liver is by no means as rare as it was formerly considered to be. Any trauma to the right thoracic cage or to the upper abdomen may involve the liver. The possibility of a penetrating injury to the liver must be considered in the evaluation of abdominal injuries seen in civilian patients. In 1936 Krieg[4] reviewing sixty cases of penetrating liver wounds found 68 per cent were due to bullets, 15 per cent to stabbings and 17 per cent to miscellaneous causes such as automobile and street accidents. The possibility of a penetrating injury to the liver is suggested by the appearance of the external wound. A diagnosis, therefore, may be more readily made in such cases than in cases of subcutaneous injury in which accurate diagnosis may be delayed and difficult.

A review of the literature of the past ten years reveals that although a minority of surgeons still attain a measure of success by treating penetrating injuries to the liver with the older technic of wound packing, those with greater personal experience, particularly in combat injuries, unequivocally recommend a definitive surgical approach. Direct surgical repair of such injuries has been made possible by the advances in surgical and anesthesia technics along with the adoption of a physiologic approach to the wounded patient.

Packing would seem to be essentially a treatment of desperation necessitated by the precarious state of the patient on reaching a treatment facility. The principle of this treatment is the control of bleeding by pressure resulting from the application of a pack. The same packing also affords an exit for bile. However, the lack of rigid supportive fixation of the liver renders the maintenance of prolonged pressure in the wound questionable. Massive packing, particularly along the superior or posterior lateral surfaces, will tend to displace the liver since the costal wall and diaphragm offer the only fixed supports to a pack. Two vascular pressures exist within the liver. The pressure within the portal component is admittedly low. On the other hand, the systemic component via the hepatic artery which furnishes the nutrient supply to the parenchyma is part of a high pressure system. Thus mild pressure which might temporarily stop venous bleeding will not affect arterial bleeding. Should the pressure of a pack be sufficient to stop hemorrhage, sequestration of liver parenchyma is likely.

Maingot[9] has reasoned that a pack might jeopardize the blood supply to the portion of a lobule separated from the hilus by a wound. Hagman[1] lists as a fourth instruction on management of liver injuries "avoid gauze packing." The use of packing, even with the newer hemostatic agents, is fraught with danger. Recurrent hemorrhage is frequent. The pack serves as a nidus for infection and sinus formation. It produces a secondary healing which is not desirable.

The treatment of choice according to current thought is reparative surgery as soon as the patient's condition is stabilized enough to permit exploration. This method of treatment attained popularity in World War II. Madding et al.[7] point out a lower mortality rate in a large series of World War II injuries to the liver compared with a similar series reported following World War I. The 27 per cent mortality in the more recent group as compared with 66 per cent mortality in the World War I group illustrates the efficacy of early surgical treatment.

Two problems confront the surgeon in exploring patients with liver injury: (1) continued bleeding which tends to obscure the depth of the wound and (2) difficulty in adequately estimating the extent of tissue damage. Blood loss can be temporarily stopped by utilization of Pringle's method of occluding the portal vein and hepatic artery as they course through the gastrohepatic omentum. The fingers of an assistant or a rubber shod clamp can be applied to this site. Once blood loss is

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controlled more exact evaluation of the tissue damage is possible. Restricted débridement may then be carried out prior to suture closure of the laceration.

Silvis[11] has recently reported the use of ribbon gut as a suture material in the repair of liver injuries. This technic deserves wider application as it eliminates many of the hazards which accompany the use of smaller suture materials. One of the cases reported by this author illustrates the necessity of accurate anatomic closure from the depth of the wound in order to obviate hidden fatal hemorrhage.

Detailed reports of the clinical course of patients treated with packing apparently have not been published. Reports dealing with complications are also rare. Due to the regenerative powers of the liver serious impairment of liver function is unlikely. Mention has been made of the so-called hepatorenal syndrome producing death, but this will probably become rare with the continued use of current supportive therapy routines. Johnson[5] reported only two cases of fistula (and these healed spontaneously) in patients of his series.

The case herein reported is rare when judged in the light of recent literature. It illustrates the fallacies of conservative treatment by packing.

CASE REPORT

On July 26, 1951, a twenty-five year old white man presented a history of having received a penetrating wound of the right posterior chest at the level of the ninth rib in the postero-axillary line. The wound was incurred when he was accidentally shot with blank ammunition while participating in a tactical problem on February 12, 1951.

This patient, hospitalized originally with a penetrating wound of the liver which was treated by packing and later by delayed exploration, had undergone five and a half months' hospitalization (Table 1), during which time he had been in the operating room fifteen times. Of these procedures at least eight could be considered major. He had received a total of thirty-nine transfusions of whole blood and approximately fifteen units of plasma, as supportive therapy during this period of hospitalization.

Examination on July 28th revealed a well developed, well nourished, young, white man weighing 150 pounds, with a well healed upper right rectus scar and a large scarred indented area overlaying the posterior axillary portion of the tenth rib on the right side. Gold colored bile was draining freely from this wound. A zone of approximately 5 cm. of granulation tissue surrounded the cutaneous site of the fistula.

The patient's complaints were limited to: (1) drainage from the back; (2) rather diffuse tenderness underlying the scar in the posterior aspect of the chest; and (3) some discomfort on deep palpation of the upper right abdomen. Physical examination otherwise was essentially negative.

Laboratory studies performed at this time revealed a red cell count of 4,000,000; hemoglobin 14 gm. per cent; white count 8,000 and polymorphonuclears 75 per cent; urinalysis was negative. The following tests performed to determine the status of liver function were all within normal ranges: total protein; albumin globulin ratio, thymol turbidity, cephalin flocculation and prothrombin time.

Drainage from the biliary fistula was quite profuse at this time. Due to the contour of the chest wall, resulting from the scar, it was impossible to arrange any mechanical device for collecting biliary drainage so as to determine the total volume. In an effort to partially alleviate the volume of the drainage in order to facilitate further evaluation of the patient, iodoform packing was used in the fistulous tract and the pack was replaced daily. This resulted in a slight decrease in drainage but it was also noted that at the time the packing was inserted the patient experienced some pain and discomfort in the upper right abdomen.

X-rays of the chest performed August 3, 1951, were essentially negative except for slight residual thickening of the pleura which was probably the result of previous hemothorax. The dome of the right diaphragm was elevated but smooth in contour.

Following about two weeks of use of the iodoform packing the drainage was moderately decreased and required dressing changes not more than twice daily. From August 18th to 23rd, after several unsuccessful attempts, a ureteral catheter was inserted into the fistulous tract and diodrast was injected through it to outline the course of the tract. Figure 1 reveals a biliary radicle continuous with the fistulous tract. Further outline of biliary radicle was not obtained by these studies.

In the middle of September while the patient was on a short convalescent leave, he experienced an attack of upper right quadrant pain which was followed by a rather profuse increase in the biliary drainage from the back. This bout of abdominal pain and increased drainage was at this time that since the episode of upper abdominal pain, biliary drainage through the back had consistently remained profuse in character but the bile was still gold colored.

On October 2, 1951, abdominal exploration was done through a right subcostal incision.

TABLE 1

HOSPITAL COURSE

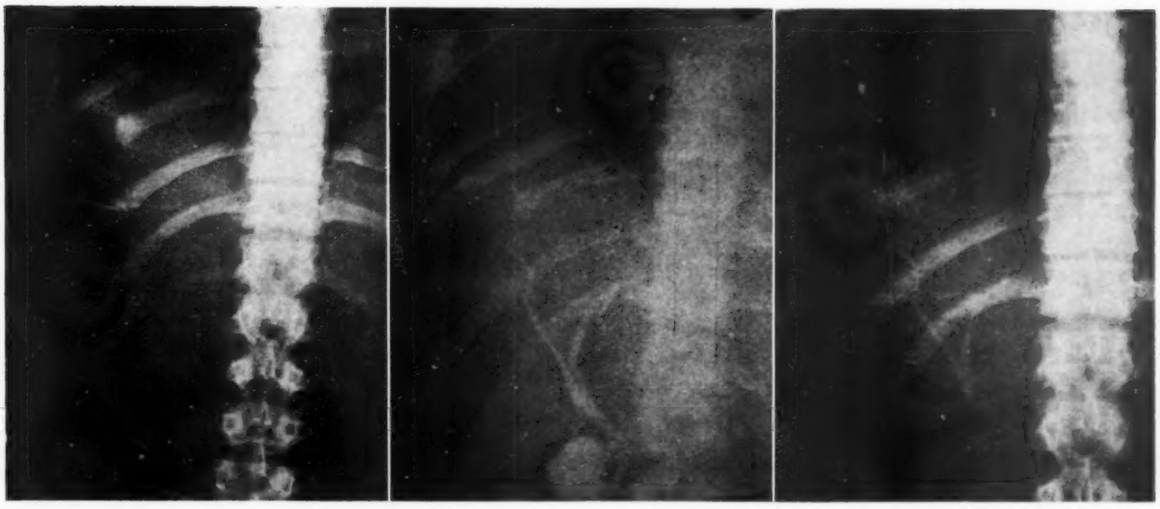
(February 12 to July 23, 1951, inclusive)

Date	Clinical Indications for Therapy	Blood Given* (cc.)	Operation	Anesthesia
2/12	Mild shock on admission	1,000	Finger exploration; wound packed	Local
2/13		500	Wound cleaned; repacked	Local
2/19		500		
2/20	Intra-abdominal hemorrhage	500		
2/24		1,000	Abdominal exploration, lacerated wound, posteriorsuperior surface, right lobe, 4-inch diameter, palpated; oxycel and gauze pack with Penrose drain	Pentothol-N2o
3/1	External massive hemorrhage	1,500		
3/9	External massive hemorrhage	2,000	4-inch segment of right 10th rib resected about wound of entry; 1,000 cc. clot evacuated from subdiaphragmatic space; wound in liver visualized 3 inches wide by 6 inches deep; bleeding in depth of wound appeared to be arterial; sutures unsuccessful; packing 16 oxycel sponges, 4 inch gauze roll (2 lengths); Penrose drains	Pentothol-ether
3/12		500		
3/17	External massive hemorrhage	1,500	Wound opened; repacked with oxycel and gauze; drains inserted	Local
3/26			Wound reopened; ooze visualized; packing with oxycel and gauze	Pentothol-N2o
3/28	External massive hemorrhage	5,000	Repacked; bleeding continued	
3/29			Wound opened; brisk bleeding, Bovie coagulation unsuccessful; sutures tied over oxycel in depth of wound; further oxycel and gauze as tamponade	Pentothol
4/10			Repacked	Pentothol-N2o
4/16	External massive hemorrhage	1,500	Reopened; Figure 8 sutures and packing	Pentothol-N2o
4/22	External massive hemorrhage	1,000	Resutured; repacked	Pentothol
5/9	Free bile drainage			
5/22			Change of packing	Pentothol-N2o
6/1			Cavity examined and packed	
7/23			Bovie to fistulous tract	

* Total blood given 16,500 cc.

definitely related to a dietary indiscretion since the patient had consumed a large meal of greasy character just a few hours before the attack. This was a completely new symptom picture and suggested that in addition to biliary fistula pathologic involvement of the extrahepatic biliary ducts was now becoming evident. Cholecystogram by the double dose technic performed on September 20th revealed a non-functioning gallbladder. It is to be noted

On exploration the liver appeared moderately enlarged, edematous and somewhat discolored. The pathologic condition was limited to the subhepatic space. The gallbladder was completely obliterated by dense adhesions. The common duct was obscured by thickened adhesions. Mobilization of the common duct revealed this process to be most marked in the supraduodenal portion. A standard choledochotomy incision was made. Approximately



1 2 3

FIG. 1. Injection of fistulous tract with lipiodol. FIG. 2. Postoperative cholangiogram showing filling of biliary radicle lying at the depth of the fistulous tract. FIG. 3. Overlay of Figures 1 and 2.

1 cc. of dark, inspissated bile escaped. Exploration of the distal common duct was then carried out with graduated dilators. Initially, moderate pressure was required to pass a small dilator through the papilla of Vater. This process was repeated with larger dilators until no resistance was encountered. Nothing suggestive of a calculous type of obstruction was encountered. A T-tube was placed in the common duct. Cholangiogram performed at this time revealed complete patency of the distal common duct although the outline of the intrahepatic radicles was not satisfactory. A Penrose drain was placed along the inferior surface of the liver and brought out through the lateral angle of the wound, the T-tube being brought out through a stab wound placed below the site of the exploratory wound.

Postoperatively the T-tube drained large volumes of thin, black bile and the drainage from the fistula did not noticeably decrease for a period of approximately fifteen days. At the end of that time the T-tube drainage became golden in color. At the same time a moderate decrease in the drainage from the back was noted.

By November 1st the drainage from the fistula was markedly decreased; and since the stools were becoming acholic, it was decided to keep the T-tube clamped for several hours during each twenty-four-hour period. This clamping did not result in an increase of drainage through the back. By November 20th the T-tube was clamped most of the day and opened for irrigation once daily. The drainage from the posterior wound had decreased to the point where it was thought a collodion pack might well serve to increase the pressure in this area and force the bile from the sinus through the T-tube. By November, 27th drainage through the back had decreased to such a point that only a small 2 by 2 inch dressing every twenty-four hours was required over the fistulous tract. Meanwhile the granulation had epithelialized and the opening was now approximately 1 mm. in diameter.

Beginning early in December approximately 2 cc. of sodium morrhuate was put into the fistulous opening every forty-eight hours to facilitate fibrosis in this area. This continued throughout the month of December. Early in January it was noted that the T-tube was becoming clogged and the patient began to experience discomfort in the right upper abdomen. Removal of the T-tube on January 25th revealed it to be completely clogged with dried bile and small sandy elements. The T-tube exit site showed complete healing by January 28th. The patient no longer complained of right upper quadrant pain. He had gained 10 pounds in weight and was employed daily working around the ward.

Following removal of the T-tube no increase in the drainage through the back was noted.

Approximately one week after the T-tube was removed, the drainage through the back was no longer bile-stained but was limited to approximately 1 to 2 cc. of mucus per day. This mucous drainage gradually decreased during February and on February 19th all drainage from the fistulous tract ceased.

At the time of this report the fistulous tract was completely closed for over ninety days. The patient maintained his weight at 160 to 165 pounds and was enjoying good health, with no complaints. He does experience occasional pain in the irregular cicatricial depression of the posterior aspect of the right chest. Liver function tests at the time of his discharge from the hospital were all within normal limits.

COMMENTS

Lichtman[6] considers trauma as the principal cause of benign strictures along the extrahepatic duct. He finds that 80 per cent of such strictures are the result of operative injury. He has noted rare instances of complete ductal obstruction resulting from diffuse inflammatory processes and points out that the most frequent sites of this type of obstruction are (1) the junction of the cystic with the common duct and (2) the supraduodenal portion of the common duct.

In the case herein reported it is obvious that the post-traumatic peritonitis in the subhepatic area was a predominant factor in the perpetuation of this fistula.

Examination of the cholangiogram (Fig. 2) made postoperatively shows drainage along the fistulous tract. Figure 3 is an overlay of the cholangiogram on Figure 1. These films tend to confirm the fact that rare biliary fistulas of this type react similarly to those which develop in relation to operative injury along the extrahepatic ducts. Like the postoperative fistulas resulting from trauma along the extrahepatic ducts, this fistula could not be expected to heal spontaneously until such time as complete patency of the extrabiliary ducts was assured. That this patient never presented clinical or laboratory evidence of jaundice, except in the immediate postcholedochotomy stage, indicates that combined drainage from the fistula and through the partially occluded common duct was sufficient to obviate the jaundice. It is believed that the fistulous tract, the course of which was against a gravity flow of bile, was not sufficient to decompress the liver in view of a gradual narrowing of the distal common duct. This fact would seem to be proven by the postoperative period in which the T-tube drained black inspissated type bile. Similarly it appears that no progress was made toward the healing of the fistula until complete decompression of the liver had taken place and biliary drainage along the common duct was of the true liver-bile character. It is to be noted that coincidentally with the change of the T-tube drainage from black to golden there was a rapid progressive decrease in the drainage from the fistula.

The long, expensive and trying hospital course of this patient might well have been obviated by definitive surgical attack on the liver at the time of initial injury.

SUMMARY

1. Treatment of penetrating wounds of the liver is reviewed.

2. A case of penetrating injury of the liver treated with packing is presented in two phases, namely, immediate treatment and treatment of a complicating biliary fistula.

3. The case presented illustrates the several fallacies of conservative treatment of liver injury.

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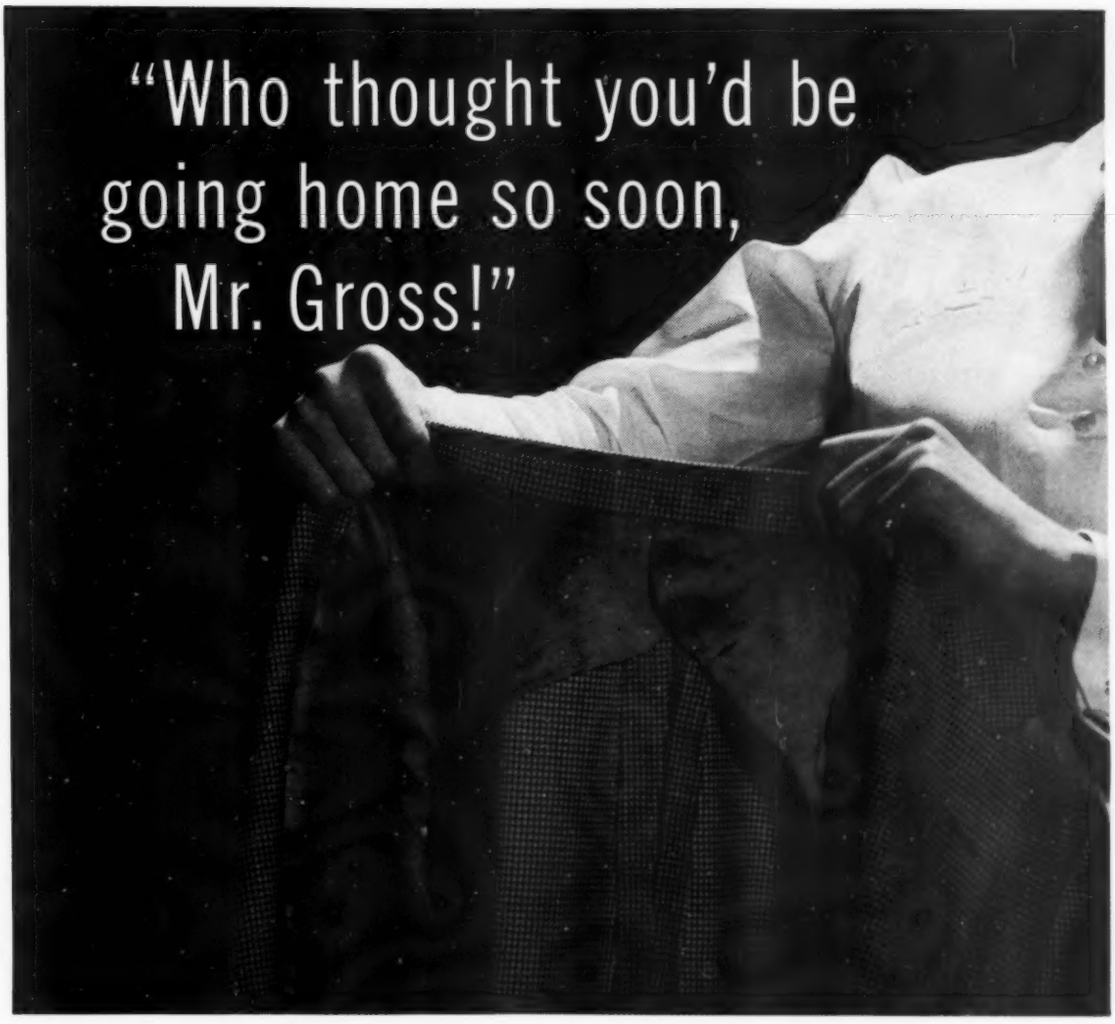

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1. Fox, C. L. Jr., et al.: An Electrolyte Solution Approximating Plasma Concentrations with Increased Potassium for Routine Fluid and Electrolyte Replacement, J. A. M. A., March 8, 1952.

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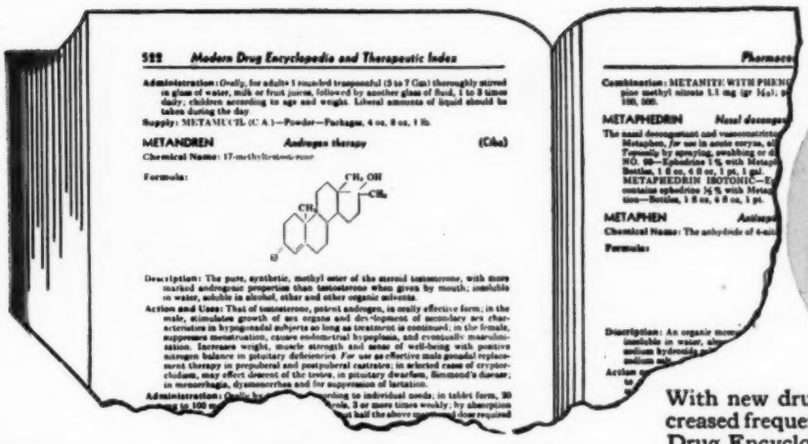
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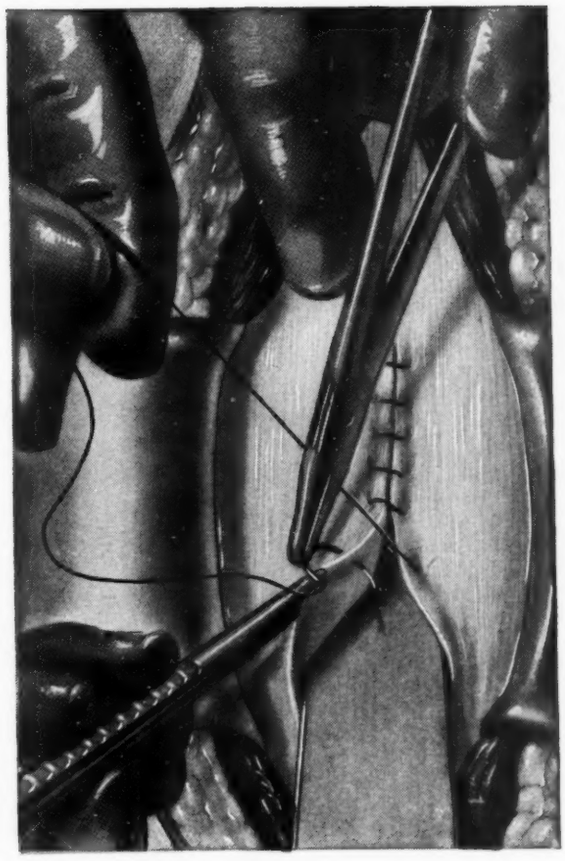

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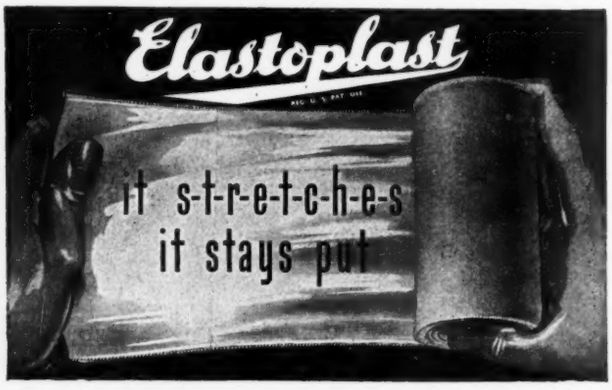

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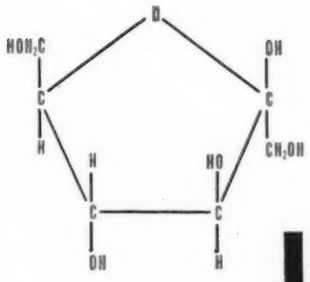

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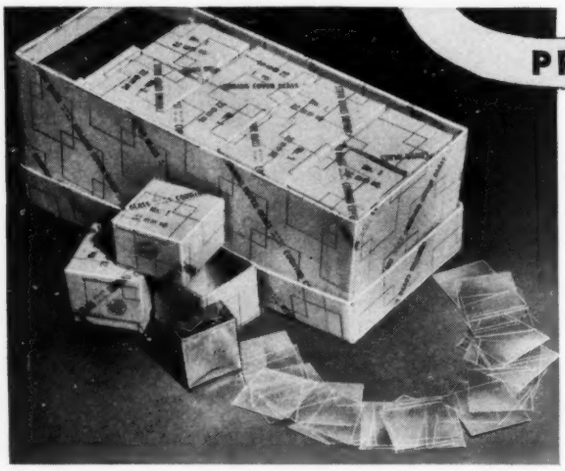

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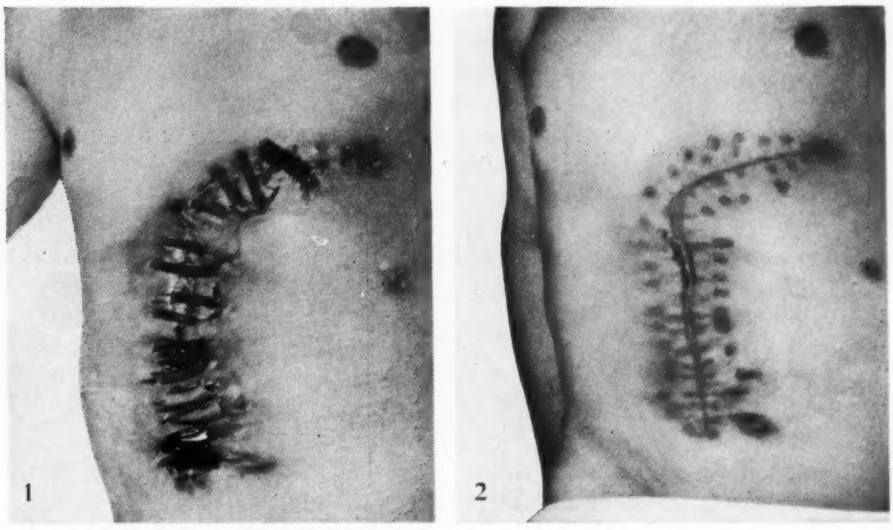

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Outside the Ivory Tower

THE January 1953 issue of the Mississippi Valley Medical Journal (Quincy, Ill.) contains all the papers read at the recent St. Louis annual meeting (Oct. 1, 1952), American Medical Writers' Association. There are papers by Dr. Walter C. Alvarez and Prof. Theodore Peterson, University of Illinois, Prof. J. Linwood Cutler, University of Missouri, Dr. Harold Swanberg, Editor, Mississippi Valley Medical Journal, and Dr. W. W. Bauer, Editor of Today's Health. The first four comprise an interesting Symposium on Medical Writing conducted at the St. Louis meeting. The two winning essays in the 12th annual essay contest, Mississippi Valley Medical Society, by Dr. Wallis L. Craddock, Salt Lake City, and Dr. Lawrence L. Craven, Glendale, Calif., are also included. The Symposium on Medical Writing has been incorporated into a twenty-four-page reprint which will interest everyone concerned with medical writing. It contains a wealth of good ideas on many phases of the written word of medicine. Free copies are available by addressing Harold Swanberg, M.D., Secretary, American Medical Writers' Association, 209–224 W. C. U. Bldg., Quincy, Ill.

CHEMICAL research on blood, which may ultimately lead to a new treatment for atherosclerosis—the underlying background of most coronary heart disease—was described at a meeting of the American Chemical Society's Northeastern Section by Professor John W. Gofman. The meeting was held at the Massachusetts Institute of Technology. A related disease called xanthoma tuberosum, which is marked by skin lesions, has been arrested and even reversed in therapeutic experiments involving the lowering of the quantities of fatty substances in the patient's blood, said Dr. Gofman, who is a physical chemist in the University's Donner Laboratory and a member of the Medical School faculty.

EVIDENCE that females, as well as males, can have hemophilia was presented at the Second Annual Symposium on Blood sponsored by Wayne University College of Medicine. Hemophilia has been considered traditionally as a hereditary disease occurring only in males, but transmitted by females.

MEDICAL scientists may someday unlock the secrets of a cure for rheumatoid arthritis in a little explored tissue in the human body. This tissue is known as "ground substance" and, in a sense, is the cement which holds together the millions of cells in all body tissue. Ground substance, which is part of the connective tissue so widely involved in rheumatoid arthritis, is finally beginning to receive the attention from scientists it deserves, according to Dr. Gideon K. DeForest, Assistant Clinical Professor of Medicine at Yale. Dr. DeForest, who is national medical director of the Arthritis and Rheumatism Foundation, said that basic research on these diseases lagged up until a few years ago, but now with more support from both the public and the doctors themselves, "the future is much brighter for the arthritic than it ever was before."

A FOURTEEN-MINUTE, black-and-white film entitled "Operation Health" is available for group showings from Lederle Laboratories Division, American Cyanamid Company. The sound film, which is 16 mm., tells the physical story of Lederle. Unlike most films produced by commercial concerns, this film does not mention or picture the name of a single product. According to Mr. Henry Wendt, Jr., Director of Sales, the film was created "to show our friends where our research is carried out, and how vast our production facilities are. Many people do not realize that Lederle employs over 4,000 people in research and production alone; that we have over 150 buildings at our Pearl River, N. Y., site, and that our scientists and production people work closely with two other divisions of American Cyanamid, the Stamford Laboratories and the Calco Division."

THE rapid inclusion of current papers in "Annual Reports on Stress" is greatly facilitated if authors of relevant papers will send their reprints as soon as these become available. Since research on "stress" is greatly aided by up-to-date periodic surveys of this complex field, several editors of major medical journals have, partly on their own initiative, encouraged their readers to send such reprints to Dr. Hans Seyle, University of Montreal, Canada.

(continued on page 46)

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The Surgical Engineering Company, Inc.

Outside the Ivory Tower

(*continued from page 44*)

RESEARCH is making a Dr. Jekyl-Mr. Hyde of medical education. Dean W. C. Davison, of Duke University Medical School, declares that as a result of emphasis on research, "Bedside medicine is becoming a lost art because it is no longer held up as the ultimate and supreme goal of medicine." The dean points out that Sir William Osler, a pioneer of modern day medicine, wanted as his epitaph: "Here lies the man who admitted students to the wards." Students are still at the bedside and in the labs, but the preclinical and clinical chiefs seldom are there to teach the students.

"These statements probably seem iconoclastic, and the sentiments will be classified as 'top secret' heresy, but it is high time that someone pointed out the dangers of research in medical schools, as well as its benefits," Dean Davison declares.

"Obviously," he says, "research is necessary for good medical education in order to stimulate the staff and students"; but although it is not the case at Duke, many clinicians feel a greater obligation toward the grantors in order to justify their research appropriations and to insure their continuance than toward the students.

Students are well taught by residents, assistants and research fellows, "but how can a student hope to obtain a philosophy of medicine and a sense of service to his patients without contact with the senior staff," who in their student days had the benefit of such contact? Dean Davison practices what he preaches, spending three mornings a week on the wards with the students.

Briefly, this is what the dean urges: (1) Medical schools should be given back to the students since "the primary reason for a medical school is instruction." (2) The medical faculty should return to teaching. That is, faculties should be selected by their ability to teach, not on the basis of the number of their publications or research projects. (3) Research in medical schools should not be overdone. "Too much research by medical school faculties may kill the goose which laid the golden eggs (assuming, of course, that well taught physicians are golden eggs)." (4) Requests for grants by the faculty should be more vigorously screened and censored by the schools themselves.

Dean Davison admits that he is as guilty as any of his colleagues, having published 163 books, research papers and articles, as well as participating in a number of research projects. Today's medical students undoubtedly know more medicine than those in the past, he says, but "the improvement is more likely due to careful selection of students than to their better instruction, efficient though it is." Students' attitudes toward their patients "leave much to be desired," Dean Davison concludes and suggests that "more intimate contact with and guidance from the physicians from an older generation would be beneficial."

A NEW kind of x-ray apparatus which takes stereoscopic photographs of a beating heart has been developed by the German physician, Dr. J. G. Netzner. Only one x-ray tube is employed to achieve the stereoscopic effect. With the aid of an oscillating frame, the tube is rapidly moved through a series of positions, each 4 degrees apart. A screen and cine-camera oscillate simultaneously with the tube. By this method about sixty individual stereoscopic pictures are obtained within one second. Dr. Netzner, an assistant of the Berlin surgeon, Professor Gohrbrandt, has thus solved a problem at which scientists have worked ever since the discovery of x-rays. A series of pictures taken by the Netzner method is invaluable for the preparation of heart operations or for the treatment of heart diseases.

THE National Paraplegia Foundation wishes to announce the continuation of a limited number of fellowships for research in spinal cord disease and trauma and in the complications commonly associated with such disease or injury. These fellowships carry a minimum stipend of $3,000 per year and may be awarded to any candidate who has demonstrated a capacity for medical research and has outlined a program of meritorious study. The fellowships will be awarded by the Medical Advisory Committee and are open for award for the academic year 1953–1954. Application forms may be obtained from the Chairman of the Medical Advisory Committee, and applications should be submitted to him not later than May 1, 1953.

(*continued on page 48*)

The Surgeon's Mart

When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.

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New convenience in skin grafting! Cuts grafts in 2⅜" strips, any thickness, any length, from any part of body. Works most efficiently with Stryker Skin Tape. Sewing not ordinarily required. Motor and dermatome can be autoclaved as a unit. Quickly converted to bone saw.

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Close-Up of Eye Taken with New Exakta "VX" Camera.

New Model with Pre-Set Diaphragm Control

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Single Lens Reflex Camera for Parallax-Free Surgical Photography

The Exakta, with both regular and telephoto lenses, is widely used in hospitals for operation room photography. Its unique through-the-lens viewing system assures absolutely correct "on the subject" photographs during every step of the operation. In addition, this world famous medical camera is regularly used for preliminary, developmental, and end result pictures of patients; for copying X-Rays; and for making color transparencies of injuries and lesions —a necessity for recording and lecturing.

With f2.8 Zeiss Tessar "T" Coated Lens with Pre-Set Diaphragm Control	$279.80
Penta-Prism Eye Level Reflex Viewfinder	50.00
Extension Tube Set	24.00
Microscope Adapter	29.50

Write Dept. 500 for free descriptive booklet "E" on camera and accessories and brochure on close-up technique with the Exakta.

EXAKTA CAMERA CO., 46 W. 29th St., N. Y. 1, N. Y.
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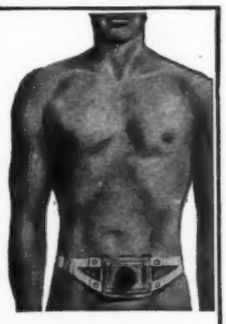
Designed for patient's comfort. Deordorizes; saves embarrassment. No bag or cumbersome apparatus. Simple design; easy to keep clean. Refer patients or write for free descriptive folder and price list to:



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- Smooth surfaces—nothing to catch on gloves.
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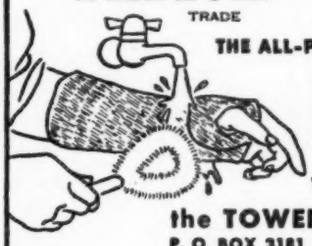

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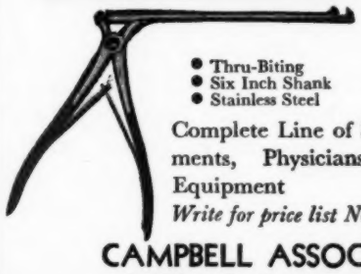

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BITE SIZES
#3—1½ x 3mm
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$50.00

Complete Line of Surgical Instruments, Physicians Supplies & Equipment

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YOUNG'S DILATORS

Extremely useful in the treatment and prevention of contracted anus (particularly following hemorrhoidectomy), as an aid in perineal dissection and repair following delivery.

Sold only on prescription—at your surgical dealer or ethical pharmacy

Adult Set sizes 1, 1½, 2, 3—for stretching anal sphincter.
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Size 3 and 4 drilled to take towel clamps—for use in perineal repair.

Write for Literature and Reprints

F. E. YOUNG & CO. 460 East 75th Street Chicago 19, Illinois

In answering advertisements please mention The American Journal of Surgery

Outside the Ivory Tower

(*continued from page 46*)

THE White Mountain Research Station on Mount Barcroft, California, in the White Mountain range near the California-Nevada border, is expected to become one of the leading high altitude research laboratories on the North American continent under a program of joint support by the National Science Foundation, the Office of Naval Research and the Rockefeller Foundation. The three agencies have obligated themselves to provide combined support totaling $36,000 per year for a three-year period.

The laboratory, open to any scientist requiring high-altitude research facilities, is under the direction of Professors Nello Pace and S. F. Cook of the Division of Physiology of the University of California. The University assumes responsibility for maintenance of the facilities under the program. At the present time, Drs. Pace and Cook are assisted by an interdepartmental committee, composed of University of California staff members representing the various disciplines of the biologic, medical and physical sciences. It is intended that this advisory committee will be broadened to include scientists from all geographic regions of the United States and from the various fields of science which require high altitude research facilities. Facilities at White Mountain now available to scientists include a center at the 10,500 foot level and another at 12,500 feet. In addition, limited experimentation may be carried on at heights up to 14,256 feet, the peak of White Mountain itself. This point is readily accessible at a distance of 3 miles from the upper laboratory. Living quarters and laboratory space are available at both the 10,500-foot and 12,500-foot levels. A colony of small laboratory animals is presently being maintained at the 10,500-foot level.

THE Schering Award competition for 1953 has begun in the nation's medical schools, it was announced by Dr. M. William Amster, chairman of the committee. Now in its eighth year, the award seeks to encourage original reporting, in the hope that the students will later contribute substantially to the development and communication of knowledge throughout the medical profession. Three $500 prizes will be awarded for the papers judged most distinctive by a panel of leading medical authorities on the subjects covered.

In preparation of papers students explore the current clinical and laboratory reports available on specific problems. They report interpretively on important recent developments in therapy. Students may also organize research team efforts.

Titles of the three general topics, Dr. Amster announced, are: antihistaminic treatment of upper respiratory allergies and infections; hormone therapy of the degenerative diseases; and new concepts in the treatment of peptic ulcer. The deadline for entry forms specifying the title chosen by the student is July 1st. The actual manuscript must be postmarked by October 1st. Manuscripts are limited to 5,000 words.

All students duly matriculated in medical schools in the United States and Canada, including those who have participated in previous competitions, are eligible. Information and instructions for the competition in 1953 are available from Schering Corporation, 2 Broad Street, Bloomfield, New Jersey.

FOUR orthopedic surgeons from the Robert B. Brigham hospital in Boston told a medical convention how they developed a new surgical technic to improve motion in knee joints made stiff and painful by arthritis. By using a nylon sheet or membrane, having a thickness of .003 to .005 of an inch, they were able to obtain "a satisfactorily functioning knee" in fifty-eight of seventy-eight arthritic knees operated upon. They pointed out that their technic improved and the results were better with each operation. The doctors, who described their technic before the 20th annual meeting of the American Academy of Orthopedic Surgeons were John G. Kuhns, Theodore A. Potter, Robert S. Hormell and William A. Elliston.

THREE major appointments in the Sales Department of Wyeth Laboratories have been announced by Stuart V. Smith, vice president and director of sales. H. F. AuBuchon and D. J. Withington, both former assistant directors of sales, have been named to the newly created posts of sales manager and director of promotion, respectively. At the same time, Mr. Smith announced that Kenneth L. Brown, copy chief for the pharmaceutical concern, had been appointed advertising manager.

(*continued on page 50*)

The Surgeon's Mart

When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.

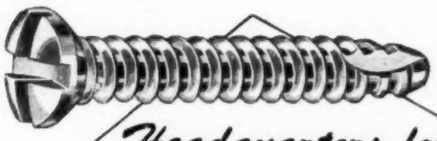
dura-sharp

VIM

stainless steel needles

will keep their keen cutting edge even after many sterilizations — the chrome-plated hub fits all U. S. standard syringes. Always specify **VIM.**

MacGregor Instrument Company Needham 92, Massachusetts



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BONE SCREWS

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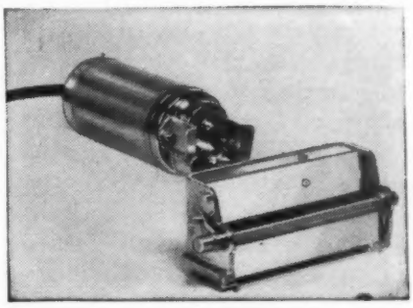

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Accurate and uniform grafts of any width up to FOUR inches and to any length. A single Surgeon using but one hand can operate this simple instrument without assistance

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Combines LOWMAN with retracting feature

Two Sizes

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Everything for the INDUSTRIAL and ORTHOPAEDIC Surgeon.

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Reduces hazard of duodenal stump disruption. Smoother post-operative convalescence. Disintegrates and discharged in 5 to 7 days post-operatively. Contains barium sulfate for x-ray purposes. Available at your Surgical Supply House.

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Azochloramid®

Brand of CHLOROAZODIN U.S.P.

An Effective Anti-Bacterial Agent in

TRAUMATIC WOUNDS • DIABETIC GANGRENE

INFECTED ULCERS • DRAINING SINUSES

1935 ACCEPTED 1952

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AZOCHLORAMID IN TRIACETIN 1:500

For moistening dressings and packings

AZOCHLORAMID SALINE MIXTURE

To prepare isotonic saline solution 1:3300 for irrigation, hot soaks, compresses, etc.

Non-toxic to tissue — Virtually non-irritating. Non-staining — Odorless — Strongly deodorizing PA-11

W&T WALLACE & TIERNAN PRODUCTS, INC., Belleville 9, N. J., U.S.A.

Outside the Ivory Tower

(*continued from page 48*)

THE annual expenditure of four billion dollars for the operation of hospitals in the United States today makes them the fifth largest business in the country. Only food products, machinery, transportation equipment and primary metal products exceed the dollar volume of general hospital operations on an annual basis. Not only is this a very important share of today's business, but each year sees this dollar volume increase. The complexity of medical care and the costs of medical care also increase from year to year. Hospitals are becoming more and more the focal point of our medical care and public health programs.

On a national average approximately one-third of the hospital operational budget is spent for supplies and other expense. The companies represented here receive many thousands of dollars from hospitals. A fair percentage of your personal or company funds are spent for health. In fact, on a national average one of every eight persons may be hospitalized in the next twelve months.

A few statistics from the operation of Roosevelt Hospital in New York City will illustrate some of the charges in medical science and many of the reasons for the increase in cost for medical care. In 1940 the average cost per patient day was $7.26. In 1951 the cost had risen to $20.13. The average income per patient day for these two years was $5.16 and $17.56, respectively. The total cost for operating the hospital for those years was $927,636 and $3,120,506, respectively. These figures show that both costs and income were three times as large in 1951 as in 1940. It is difficult to tell how much of this change is directly attributed to inflation, how much to an honest increase in costs and wages or how much to credit to a successful Democratic administration.

The costs of medical care today are partly due to the increased use of diagnostic aids. A few of these would be the electroencephalograph, direct writing cardiograph, flame photometer, laminograph for x-ray, many blood chemistry tests, new methods for visualization of cancer cells, etc. All of these added to the routine tests familiar ten years ago have increased laboratory examinations at the Roosevelt Hospital from 83,000 in 1940 to 116,000 in 1951. X-ray examinations for the same period increased from 37,000 to 76,000.

A corollary of this marked increase in the use of laboratory and x-ray is, of course, the need for additional personnel. Total personnel for the Roosevelt Hospital increased from 651 in 1940 to 952 in 1951. Part of this increase is due to the adoption of the forty-hour week late in 1950. The ratio of personnel to beds for these two years was 1.6 and 2.3, respectively. Therefore, a 50 per cent increase in personnel was required to staff the hospital on a shorter work week, plus the added diagnostic work done, more operations, plus the fact that many more patients were admitted in 1951 (9,178) than in 1940 (7,390), and the number of patients visiting the emergency room increased from 31,000 to 37,300.

The amounts paid for salaries for the two comparison dates ($564,258 in 1940 and $2,100,195 in 1951) shows the effect of increased cost of personnel, but also that hospitals have been required to increase their salaries more on a percentage basis than other industries because the hospital did not have as good personnel policy nor wage scales in 1940 as in 1950.

If we in hospitals are to achieve better acceptance of our increased costs we must be willing to share information about our business procedures.

THE amazing achievements of medical science and new drugs in lengthening man's life span from forty-nine years to almost sixty-eight years in the past half-century are nevertheless creating "a nation of idle oldsters," due to compulsory retirement of workers at the age of sixty-five, Dr. Theodore G. Klumpp, president of Winthrop-Stearns Inc., pharmaceutical manufacturer, said. He called "archaic" the arbitrary policy of scrapping workers sixty-five years of age or over, whether or not they are capable of additional years of useful production. In addition, Dr. Klumpp stated, fixed retirement is economically and socially harmful and a waste of fifty years of medical science's efforts in adding nineteen years to human life. The occasion for Dr. Klumpp's remarks was the Founders' Day program of the Philadelphia College of Pharmacy and Science, marking the institution's 132nd anniversary. It is the oldest school of pharmacy in the United States.

(*continued on page 52*)

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POTENT ANESTHESIA in Itching and Surface Pain

Via 20% Dissolved Benzocaine

A rapid control of surface pain in many post-surgical conditions: Hemorrhoidectomies, episiotomies, amputations, removal of tape. Also to prevent pain in rectal and other examinations and instrumentation. Available "Clear" and "With Chlorophyll."

Americaine
TOPICAL ANESTHETIC OINTMENT

Send for FREE SAMPLES

ARNAR-STONE LABORATORIES, INC.
(Formerly Named Americaine, Inc.) Evanston, Ill.

Jayne Bryant
SAFETY-CHECK BLANKET

COMFORT *plus* SAFETY FOR ALL CONCERNED!

The *Jayne Bryant* Safety-Check Blanket provides safety, comfort and more freedom of movement for confused, agitated, excitable or violent patients, either hospitalized or in home confinement. *Write for complete information.*

Jayne Bryant **SAFETY-CHECK BLANKET**
Dept. J.S., 7646 Vincennes Ave., Chicago 20, Ill.

***Dramatic New* SKIN PROTECTANT**

Containing for the First Time—SILICONES*

Adhesive—Moisture Repellent—Inert

To protect skin against maceration in colostomy drainage, ileostomy, cavernostomy, proctitis, diabetic gangrene, etc. Effective in many cases formerly failures under accepted therapy. Said to outmode zinc oxide ointment, aluminum pastes, calamine, etc.

ARNAR-STONE LABORATORIES, INC.
1316-A Sherman Ave. Evanston, Ill.

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FREE *Send for Sample and Literature*

SILICOTE
SILICONE OINTMENT

FOR COLOSTOMY IRRIGATION
A Triple Purpose Shield

It is a positive aid in controlling the offensiveness of irrigation; allowing the patient to irrigate in the accepted manner, using a catheter of choice and inserting to desired depth.

The cover which is placed over the top of shield as soon as the catheter is withdrawn conceals all offensiveness and serves as a desk top Thus, the time necessary for patient to complete the irrigation can be devoted to some useful purpose, directing the patient's mind away from an unpleasant job.

Write today for the booklet "My Colostomy" and literature on the Triple Purpose Shield.

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Davy Surgical Buttons Hold Retention Sutures Firmly

Non-Slipping
Less Scar Formation
Clean—Comfortable
Made of Aluminum

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Excellent for Mastectomy as well as Laparotomy

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BRAND NEW GOV'T SURPLUS
SURGICAL INSTRUMENTS
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AT 50% BELOW REGULAR COSTS
all merchandise on approval
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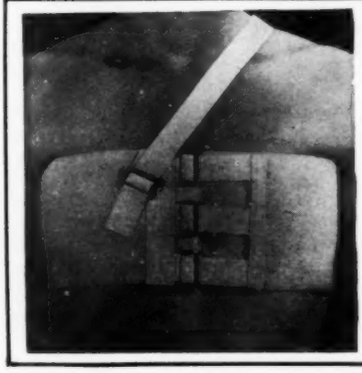

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SHIP TO:

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Outside the Ivory Tower

(*continued from page 50*)

MERCK & CO., INC., manufacturing chemists, announces the completion of a 16 mm. kodachrome sound film, running time thirty-six minutes, which is the first motion picture showing therapy for several of the more than fifty diseases that have been known to respond favorably to Cortone, the Merck brand of cortisone. There are five clinical presentations in the film featuring "before and after" studies of actual case histories. Patients shown include a forty-six year old male with rheumatoid arthritis, a six-year old boy with rheumatic fever, a forty year old housewife with pemphigus, a fifty-seven year old salesman with status asthmaticus and a nine year old boy with acute traumatic iritis.

Titled "Therapy with Cortone," the film is being made available for showings to medical, pharmacy and allied groups. Those interested in obtaining a print for showing should write to Merck & Co., Inc., Rahway, N. J., Attention: Field Sales Department.

CATASTROPHIC accidents, defined as those killing five or more persons, claimed approximately 1,550 lives in the United States last year, about 250 less than the 1951 total, Metropolitan Life Insurance Company statisticians report. Most costly in loss of life was the series of tornadoes which ravaged the Mississippi valley on March 21st and 22d and caused 229 deaths—the heaviest toll in a single disaster since 1947. Six other accidents taking 25 or more lives in 1952 were: Military plane crash near Moses Lake, Wash., eighty-seven deaths; military plane crash at Tacoma, Wash., thirty-seven deaths; scheduled passenger plane crashes in Elizabeth, N. J., sixty-three deaths; non-scheduled passenger plane crash near Los Angeles, twenty-nine deaths; collision of two buses near Waco, Texas, twenty-eight deaths. The improved record for catastrophes in 1952 as compared with 1951 was traceable largely to the marked drop in the number of lives lost in railroad and civil air accidents, according to the statisticians.

BONE that is preserved by freezing in hospital bone banks throughout the country is better than bone preserved chemically according to a survey announced by the American Academy of Orthopedic Surgeons.

SCHOOLS of professional nursing in the United States admitted 42,103 new student nurses in 1952, it was announced recently by Theresa I. Lynch, Chairman of the Committee on Careers in Nursing, National League for Nursing, which conducts the national student nurse recruitment program. An additional 439 students entered nursing schools in Hawaii and Puerto Rico, bringing the total number of new students nurses in the United States and territories to 42,542 in 1952, compared to a total of 42,053 in 1951.

A NEW film on enzymatic therapy has been made available to medical schools and professional groups by Lederle Laboratories Division, American Cyanamid Company. Titled "Enzyme Therapy with Varidase," this 16 mm. film shows actual case applications of the new drug. The film is in color, has sound and runs eighteen minutes.

Varidase streptokinase-streptodornase reduces the viscosity of blood clots and pus, thus aiding drainage and antibacterial medication in wounds that are open or in a body cavity. The new film shows Varidase application to chronic ulcers, pilonidal cysts, hemothorax and empyema, osteomyelitis, burns, acute purulent sinusitis and certain complications arising in the presence of peripheral vascular disease. The film can be obtained by writing to: Film Library, Lederle Laboratories Division, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y.

AMERICAN women visit their dentists more regularly than men. Although both men and women have the same amount of dental disease, only two-thirds as many women have lost all their teeth.

TUBERCULOSIS took only one-third as many lives in the United States in 1952 as twenty years ago, although our population has increased by more than a fourth in that time, according to Dr. Louis I. Dublin of the Metropolitan Life Insurance Company. Nevertheless, tuberculosis remains a major medical and public health problem in this country because the known frequency of the disease has not declined at the same rapid pace as the death rate.

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When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.

The Primer Bandage (moist) and the Dalzoflex Bandage (elastic adhesive)—suggested in the Pressure Treatment of

LEG ULCERS, VARICOSITIES

and other ailments of the extremities where pressure is indicated. ***It Costs no more to use the best!***

Catalog and price-list on request

Medical Aids Inc.

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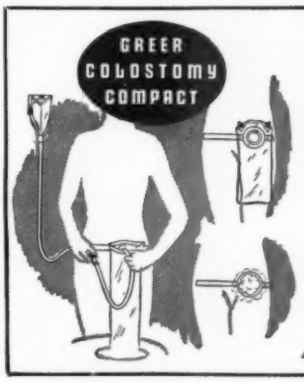
A SOAP PACKED WITH ANTISEPTIC POWER

Maintains low bacteria count hours after use—will not irritate normal skin. Available in liquid and bar form. Clinic proven

LANCO ANTISEPTIC SOAP

LANAIR Chemical Corp.
236 W. North Ave. • Chicago 10, Illinois



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Hastens patients' hospital discharge. Pleases and equips the patient completely without individual fittings or any "extras" to buy.

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The exclusive

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EXAMINING TABLE FOR RECTAL AND ROUTINE EXAMINATIONS

Patented proctological position recommended by specialists provides comfort, yet patient cannot move during instrumentation. Priced lower, yet it is two tables in one. Converts in 30 seconds to a handsome examining table.

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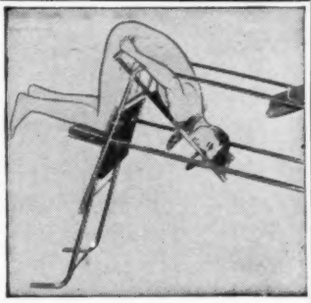

EDER INSTRUMENT CO.
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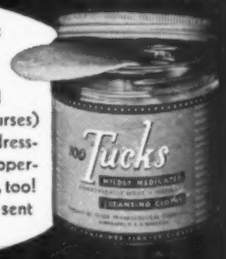

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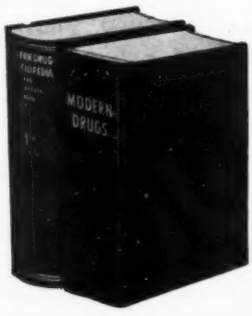

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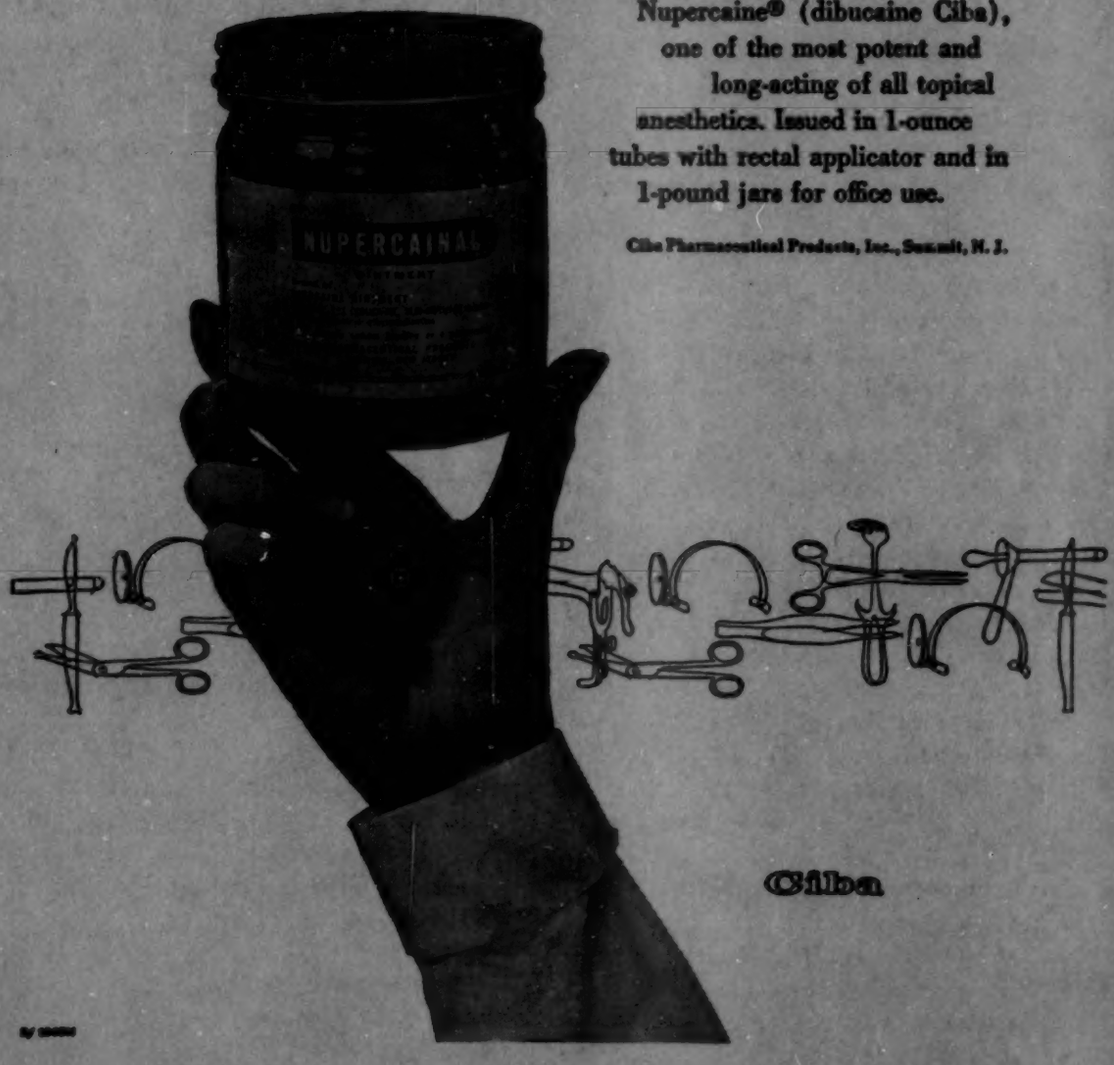

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